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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1986.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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05 WATER QUALITY MANAGEMENT AND PROTECTION

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06 WATER RESOURCES PLANNING

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

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Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W86-02715

2. WATER CYCLE

2A. General

BASIN-SCALE EVAPOTRANSPIRATION DETERMINATION THROUGH WATERSHED AND CLIMATE ANALYSIS,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 2D.
W86-02420

DEVELOPMENT OF A SIMPLE, RELIABLE, INDEX OF DROUGHT WARNING AND DROUGHT EMERGENCY TO AID MUNICIPAL WATER SUPPLY MANAGEMENT,
Delaware Univ., Newark. Dept. of Geography.
J. R. Mather.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-218980/AS, Price codes: A03 in paper copy, A01 in microfiche. Delaware Water Resources Research Center, Newark, Project Completion Report, 1984. 25 p, 7 tab, 7 ref. USGS G833/05. 14-08-0001-G833/05.

Descriptors: Drought, Hydrologic budget, Water shortage, New Jersey, Drought index, Planning.

The goal of the present research was to achieve a simple, reliable, easily evaluated index of drought that could be used to alert county and State officials to the development of conditions that might result in water shortage for municipal and industrial users. A survey of various drought identification techniques using data from Delaware for the past twenty or more years not only revealed a number of their shortcomings but also suggested two techniques that had the desired qualities of simple, reliable and easily evaluated. One, the newly formulated Phillips drought index, is based on exceedance probabilities of monthly precipitation but it can also shift to utilize daily data when the need arises in order to present drought information on a real-time basis. The other, the NOAA cumulative precipitation program, uses weekly precipitation data summed as running eight-week totals and their deviations from normal. An evaluation of both techniques revealed the need to incorporate data from a number of stations in each county because of the great local variations in precipitation that exist even within fairly homogeneous areas as well as the need to base normals or probabilities on fairly long periods of record because of the influence of just a few years of very dry or very wet conditions on the normals.
W86-02545

MATHEMATICAL MODELS FOR UNGAGED WATERSHEDS WITH POTENTIAL FOR QUANTIFYING THE EFFECT OF LAND USE CHANGES ON STREAMFLOW,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
V. P. Singh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-219012/AS, Price codes: A08 in paper copy, A01 in microfiche. Technical Completion Report, Louisiana Water Resources Research Institute, Baton Rouge, October 1984, 143 p, 35 fig, 11 tab, 183 ref. USGS G845-03.

Descriptors: *Louisiana, *Rainfall-runoff relationships, *Mathematical models, Response time characteristics, Hydrograph characteristics, Direct runoff, Effective rainfall, Unit hydrograph, Ungaged watersheds, Streamflow.

There has been a growing need in the United States to Quantify the impact on watershed hydrology of such land use changes as urbanization, forest clearing, surface mining, construction and agricultural practices. This is required to satisfy federal legislation and anticipate the potential impacts so that ecological and environmental detriment can be minimized. This study was undertaken to evaluate existing mathematical models for simulation of streamflow from watersheds with insufficient hydrologic data. Response time and hydrograph characteristics were included in evaluation. On recognizing limitations of these models and taking advantage of experience with their use, a mathematical model based on drainage network characteristics was developed. Because it contains parameters which can be determined from physically measurable watershed characteristics, the model is eminently suitable for ungaged basins. Its parameters are affected by land use changes. Therefore, the effect of these changes can be quantified. Paucity of data did not allow this quantification on natural watersheds.
W86-02548

MIGRATION OF HEAVY ELEMENTS IN GROUNDWATER FOLLOWING URANIUM SOLUTION MINING OPERATIONS,
Wyoming Univ., Laramie. Coll. of Engineering.
M. J. Humenick, R. J. Charbeneau, and B. Hassler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-226314/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, Wyoming Water Research Center, Laramie, September 1984. 74 p, 17 fig, 2 tab, 1 app, 1 ref. USGS G878-05.

Descriptors: *Wyoming, *Simulation models, *Path of pollutants, *Uranium, Mine wastes, Groundwater, *Groundwater pollution, *Uranium mining, *Mathematical models.

Simulation models and example output are presented for the analysis of heavy element migration in ground water from in-situ uranium solution mining sites under conditions of ground water flow. The models are one dimensional and include the effects of advection, dispersion, mass transfer, and equilibrium for selected heavy elements. Previous laboratory data for uranium, molybdenum, vanadium, selenium and arsenic were used to obtain necessary mechanistic relationships used in the models. Hydrologic characteristics and status of solution mining sites in Wyoming are presented.
W86-02578

EVALUATION OF THE NWS SOIL MOISTURE ACCOUNTING MODEL FOR AUTOMATED FLASH FLOOD FORECASTING IN SMALL ARID AND SEMI-ARID WATERSHEDS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
S. Sorooshian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-229722/AS, Price codes: A03 in paper copy, A01 in microfiche. Research Project Technical Completion Report, Arizona Water Resources Research Center, Tucson, Sept 1984. 37 p, 5 fig, 1 tab, 28 ref, 2 append. USGS G828-08.

Descriptors: *Flood forecasting, Flash floods, Arid zone hydrology, Computer models, *Arizona, Rainfall-runoff relationships, Infiltration.

An analysis of the NWS model and the hydrological characteristics of small arid watersheds indicated that modifications to the model would be necessary for arid zone applications. One modification, based on the absence or insignificance of base-flow in the typical small, arid watershed, involves removal of the lower zone reservoirs and replacement of the complex percolation function by a proportional loss rate. In light of the extreme rainfall intensities and rapid runoff rates associated with desert floods, the infiltration representation was revised so that overland flow may begin before the upper zone is saturated and so that maximum infiltration capacity is a parameter. Other modifications include the use of watershed subcells and routing which simulates percolation of flows into the channel bed. The amount of data required for model calibration can be reduced by the use of the modified model in conjunction with recommended calibration procedures.
W86-02601

EFFECT OF STOCKPONDS ON DOWNSTREAM SURFACE WATER YIELDS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
J. L. Thames.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233005/AS, Price codes: A05 in paper copy, A01 in microfiche. Research Project Technical Completion Report, Arizona Water Resources Research Center, Tucson, Sept 1984. 69 p, 18 fig, 7 tab, ref, append. USGS G828-09.

Descriptors: Water yield, *Stock ponds, Stochastic models, Watershed models, *Rainfall-runoff relationships, Livestock, Small watersheds, Arizona, Model studies.

A computer simulation model is presented for evaluating the performance of small water impoundments. This model originally developed by Charles Almestad (unpublished M.S. Thesis, U. of Arizona, 1983) was modified in this project for use in the desert scrub vegetation type of southeastern Arizona. A stochastic model of precipitation was used to generate a synthetic time stream of precipitation, and the SCS runoff formula was used to convert rainfall to runoff. An autoregressive maximum daily temperature model was used to estimate evaporation. These three model components were linked in the final computer program, PONDY. This program was used to synthesize the hydrologic behavior of stock ponds using a range of pond geometries, pond sizes, watershed sizes and seepage rates. Output of the program consists of statistics on annual water retention, annual spillage, and the number of days of a pond is dry on an annual and monthly basis. All statistics are based on 200-year. simulation runs for each pond-watershed-seepage condition.
W86-02645

POTENTIAL SEEPAGE LOSSES IN AN ALLUVIAL CHANNEL--RIO GRANDE BASIN BETWEEN COCHITI DAM AND ELEPHANT BUTTE RESERVOIR, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. L. Gold.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4268, 1985. 22 p, 13 fig, 5 tab, 10 ref.

Descriptors: *Seepage, *Model studies, *Surface-groundwater relationships, Aquifer, Alluvial channels, Groundwater recharge, Streamflow, *New Mexico, *Rio Grande Basin, Cochiti Dam, Elephant Butte Reservoir.

A two-dimensional, digital, cross-sectional model was used to simulate seepage of water from an alluvial channel, which had the general characteristic of the Rio Grande channel, into the underlying alluvium within the reach from Cochiti Dam to Elephant Butte Reservoir. Seepage rates were determined for losing and gaining reaches, and reaches affected by pumping of ground water. The seepage rates were computed for stream surcharges (height of additional water applied on top of base flow) ranging from 0.5 foot to 3 feet and for application periods ranging from 1 to 100 days. The net seepage rates, which were nearly identical for each type of reach, ranged from 0.0 cubic foot per second per mile of channel length for a 0.5 foot surcharge applied for 1 day to 0.37 cubic foot per second per mile of channel length for a 3 feet

surcharge applied for 100 days, followed by a 180 day seepage return flow from the aquifer. (USGS)
W86-02779

ANALYSIS OF URBAN RUNOFF DATA AND EFFECTS ON THE SOUTH PLATTE RIVER, DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02813

ANALYSIS OF WATER-LEVEL FLUCTUATIONS OF THE U.S. HIGHWAY 90 RETENTION POND, MADISON, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. C. Bridges.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4057, 1985. 19 p, 8 fig, 5 tab, 6 ref.

Descriptors: *Water level fluctuations, *Simulation analysis, Storm water, Retention basin, Florida, Madison.

A closed basin stormwater retention pond, located 1 mile west of Madison, Florida, has a maximum storage capacity of 134.1 acre-feet at the overtopping altitude of 100.2 feet. The maximum observed altitude (July 1982 to March 1984) was 99.52 feet (126.7 acre-feet) on March 28, 1984. This report provides a technique for simulating net monthly change-in-altitude in response to rainfall and evaporation. A regression equation was developed which relates net monthly change in altitude (dependent variable) to rainfall and evaporation (independent variables). Rainfall frequency curves were developed using a log-Pearson Type III distribution of the annual, January through April, June through August, and July monthly rainfall totals for the years 1908-72, 1974, 1976-82. The altitude of the retention pond increased almost 7 feet during the 4-month period January through April 1983. The rainfall total was 35.1 inches, and the recurrence interval exceeded the 100-year January-April rainfall. (USGS)
W86-02881

2B. Precipitation

CHARACTERIZATION OF ALUMINUM CHEMISTRY FOR ACID PRECIPITATION,
Vermont Univ., Burlington. Dept. of Civil and Mechanical Engineering.
D. R. Hemenway, and B. Fitzgerald.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214542/AS, Price codes: A03 in paper copy, A01 in microfiche. Vermont Water Resources Research Center Completion Report, Burlington, December, 1984. 21 p, 7 fig, 2 tab, 23 ref. USGS G873-05.

Descriptors: Acid precipitation, *Aluminum, *Precipitation chemistry, Speciation, Acidic deposition, *Acid rain.

Aluminum has come under increasing scrutiny as a toxic element either being released by acid precipitation interaction with soils or by being transported in the primary precipitation event. The study describes several analytical techniques for quantitatively evaluating the form of aluminum. A unique method of using molecular weight (mw) cut-off filtration and the 8-hydroxy quinulate extraction technique to assess monomeric aluminum speciation has been developed. A cut-off mw filter of 50,000 was found to be effective in separating monomeric aluminum from other aged forms of polymeric species found in precipitation.
W86-02458

MIGRATION OF HEAVY ELEMENTS IN GROUNDWATER FOLLOWING URANIUM SOLUTION MINING OPERATIONS,
Wyoming Univ., Laramie. Coll. of Engineering.
For primary bibliographic entry see Field 2A.
W86-02578

STATISTICAL ANALYSES OF SPATIAL AND TEMPORAL STORM RAINFALL CHARACTERISTICS IN PUERTO RICO,
Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering.
I. Pagan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-247955/AS, Price codes: A12 in paper copy, A01 in microfiche. Puerto Rico Water Resources Research Institute, Technical Completion Report, Mayaguez, 1984. 253 p, 33 fig, 30 tab, 24 ref. USGS G866-03. 14-08-0001-G-866.

Descriptors: *Rainstorms, *Statistical analysis, *Frequency distribution, Rainfall distribution, Rainfall intensity, *Puerto Rico.

Hourly rainfall data from ten representative rainfall stations in Puerto Rico were analyzed to determine storm rainfall characteristics. Spatial and temporal variabilities of storm rainfall were presented. Storm events were identified objectively. Storm durations for various events were estimated. Mean storm rainfall intensities were found for all historical storms with mean intensities higher than 0.20 in/hr. Non-dimensional storm rainfall distributions were found for all the stations. The distributions were stratified by storm duration and storm class where a class is defined as the portion of the storm with heavier rainfall. Frequency analyses were done on storm durations, and storm rainfall intensities. Relevant tendencies were analyzed. Daily rainfall distributions at various stations were found. Three predominant tendencies were found, namely, skewed uni-modal, bi-modal, and multi-modal distributions. Frequencies analysis of order statistics was done on storm data and hourly data independent of storm events. Relevant discrepancies are between both analysis. Results suggest that the intensity-duration-frequency design criteria recommended by National Weather Service (Technical Paper No. 42) need to be updated.
W86-02675

2C. Snow, Ice, and Frost

SNOWMELT INFILTRATION INTO FROZEN GROUND,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. L. Kane.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214740/AS, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 184-17, March, 1985. 14 p, 2 fig, 4 tabs. USGS G827-05.

Descriptors: *Snowmelt, *Seasonal frost, *Runoff, *Infiltration, *Alaska, Groundwater recharge, Frozen soil, Frozen ground.

Recent research has shown that the rate of runoff from snowmelt can be related in part to the condition of the underlying frozen soil. Quantification of this generalization cannot be made until both processes that result in soil-water redistribution and infiltration into seasonally frozen soils are understood. This project sought to collect field data on the process of snowmelt runoff generation with the hope that, in the next phase of research, we can modify existing models to improve runoff predictions for snowmelt events. Runoff from four bounded plots was collected. The volume of runoff was compared with results obtained from previous years of data collection for varying soil-moisture conditions. Surveys to quantify the snowpack and meteorological data were also collected. For the runoff plots, the percentage of runoff to the maximum snowpack content varied from 15% to 25%. This compares to results from other years that varied from 0% to 56%. High runoff ratios are generally associated with high soil moisture contents and low runoff ratios with low soil moisture contents. A strong correlation appears to exist between the antecedent precipitation prior to freeze-up and the seasonal volume of snowmelt runoff. This relationship could be useful for improving model prediction capability.
W86-02477

2D. Evaporation and Transpiration

BASIN-SCALE EVAPOTRANSPIRATION DETERMINATION THROUGH WATERSHED AND CLIMATE ANALYSIS,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
L. A. Harper, W. M. Snyder, and D. W. Kolber.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-222174, Price codes: A04 in paper copy, A01 in microfiche. Report ERC 01-83, Environmental Resources Center, Georgia Inst. of Technology, Atlanta, April 1983, 48 p, 12 fig, 7 tab, 11 ref. A-103-GA.

Descriptors: *Hydrologic models, *Evapotranspiration, *Rainfall-runoff relationships, *Deep seepage, *Water loss, *Basins, *Storage capacity, Models, Climatology, Model studies, Seepage, Runoff, Rainfall, Precipitation, Evaporation, Storm runoff, Storm seepage, Climatic data.

A model was developed to express evapotranspiration as a function of recovery of basin storage capacity between storms. Non-linear least squares were used to simultaneously evaluate five parameters structured to estimate evapotranspiration as a function of pan evaporation and three parameters expressing deep seepage. This new model could not be satisfactorily optimized probably due to difficulty in calculating storm event runoff and precipitation at the basin scale. A water yield model used for comparison utilizes monthly rainfall and runoff data providing more stability in parameter estimation. However, since water yield models must inherently contain some expression of evapotranspiration losses in that structures, an attempt was made to re-interpret results of the successful optimizations. A summation of delayed runoff for six months following the month of rainfall input (potential runoff) was used to calculate what was not runoff. These values were plotted for three of the four basins that had continuous flow to identify two loss components, evapotranspiration and deep seepage. These two loss components could be used in water resource planning if additional research is conducted to make them applicable to other basins.
W86-02420

FIELD MEASUREMENT OF EVAPORATION AND TRANSPIRATION FOR IRRIGATED CORN, SORGHUM AND SOYBEANS,
Nebraska Univ.-Lincoln. Dept. of Agricultural Engineering.
D. L. Martin, and N. L. Klocke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227296/AS, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, Nebraska Water Resources Center, Lincoln, September 1984. 41 p, 10 fig, 2 tab, 8 ref. USGS G854-08. 14-08-0001-G854.

Descriptors: *Evaporation, *Transpiration, *Evapotranspiration, Lysimeters, *Nebraska, Corn, Sorghum, Soybeans.

Field and laboratory experiments were conducted to develop and evaluate techniques of separately measuring evaporation and transpiration of corn, sorghum and soybeans. Large, hydraulically weighing, lysimeters were used to measure evapotranspiration in the usual manner. Another set of lysimeters were equipped with vinyl covers to prevent evaporation but to allow crop growth and transpiration. Evaporation from bare soil and beneath the crop canopy was also measured using the hydraulic lysimeters and small (15 cm diameter x 20 cm deep) mini-lysimeters. Results showed that the thermal regime of the soil in the mini-lysimeters was comparable to that in the surrounding field area, but that special management of the mini-lysimeters is needed to maintain a representative soil moisture condition. The evaporation rate appears to be significantly affected by the moisture content of the mini-lysimeter. With proper management the mini-lysimeters are more representa-

tive than the hydraulic lysimeters for evaporation measurement since the moisture content can be controlled with the mini-lysimeters. The transpiration from corn was successfully measured; however, more analysis is needed to refine transpiration data available at this time.
W86-02594

WATER RELATIONS OF HIGH-ELEVATION SALIX PHREATOPHYTES IN WYOMING,
Wyoming Univ., Laramie. Coll. of Arts and Sciences.
D. R. Young, I. C. Burke, and D. H. Knight.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-229755, Price codes: A02 in paper copy, A01 in microfiche. Technical Completion Report, Wyoming, Water Research Center, Laramie, September 1984. 23 p, 3 tab, 3 fig, 22 ref. USGS G879-06.

Descriptors: *Wyoming, *Phreatophytes, *Willow, *Forest hydrology, *Transpiration, Soil-water-plant relationships.

High-elevation phreatophytes were studied to identify environmental parameters influencing daily and seasonal water consumption. The water relations of Salix planifolia, S. wolfii, and Betula occidentalis at 2865 m were similar throughout the day. Transpiration was reduced before 1,000 h as a result of dew on the leaves, but high stomatal conductances to water vapor diffusion and transpiration flux densities occurred from 1,000 to 1,6000 h, resulting in a daily water loss per unit leaf area of 4.5, 5.2, and 4.0 Kg m-2, respectively. The period of significant water consumption was from 10 July through 20 September. For comparison, a site at lower elevation (2,255 m) was examined. Diurnal variations of S. exigua and S. amygdaloides at this site were similar to the high-elevation site, but maximum stomatal conductances were only 51 percent of the high-elevation Salix species. However, transpiration occurred from sunrise to sunset at lower elevations, resulting in a daily water loss of 3.7 and 3.4 Kg m-2 of leaf area, respectively. A midday depression in leaf conductance at the lower site may have been in response to xylem pressure potentials below-1.7 MPa. The growth season at the low-elevation site was estimated to be from 15 June to 30 September. Although differences between the two sites occurred, the data suggest that for both sites and all species examined, stomatal conductance and seasonal water use were most influenced by solar irradiance, dew on leaves, minimum air temperatures in spring and fall, and phenology.
W86-02604

ANALYSIS OF WATER-LEVEL FLUCTUATIONS OF THE U.S. HIGHWAY 90 RETENTION POND, MADISON, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2A.
W86-02881

2E. Streamflow and Runoff

ASSESSMENT OF CHANGES IN STORM AND SEASONAL RUNOFF RESPONSE OF WATERSHEDS IMPACTED BY MT. ST. HELENS ASH DEPOSITION,
Washington Univ., Seattle. Dept. of Civil Engineering.
B. Datta, D. P. Lettenmaier, and S. J. Burges.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-204014/AS, Price codes: A06 in paper copy, A01 in microfiche. Technical Completion Report No. 82, August 1983. 105 p, 36 fig, 15 tab, 13 ref. Bu Rec C-00234 (1429)(1). 14-34-0001-1429.

Descriptors: *Washington, *Mt. St. Helens, *Runoff forecasting, Volcanoes, Runoff, Catchment areas, Watersheds, Model studies, Orographic precipitation, Snowmelt, Storm runoff.

The most significant effects of the ash deposition following the major Mt. St. Helens eruptions during May to July 1980 were twofold. The immediate consequence of the ashfall was either to increase or decrease the runoff from snow-covered areas, depending upon the thickness of the ash cover. The second consequence of the ashfall was to change the hydrologic response of ash covered catchments to a given amount of precipitation. To study the changes in the hydrologic response of a catchment, it was necessary to model both the snowmelt process to determine effective precipitation and the transformation of effective precipitation to runoff. Difficulties in calibrating existing snowmelt models due to large variations in topography and precititation patterns led to rejection of classical approaches. As an alternative, it was decided to modify the Constrained Linear System (CLS) model in such a way that the physical characteristics of the catchments could be explicitly incorporated. The modified CLS model was calibrated for the period October 1972 to September 1976 for the Toutle River on a daily time scale. The model was run in prediction mode for the period June 1980 to September 1982. An analysis of the prediction errors show that the overall post-eruption hydrologic response of the catchment remained practically the same for the months from October to March. For other months, particularly June to September, the post-eruption runoff for given precipitation was less than under pre-eruption conditions. These results may be attributable to a post-eruption increase in ponding or depression storage capacity due to debris and blast deposits in the catchment.
W86-02434

FLOW PROPERTIES OF THE MT. ST. HELENS MUDFLOW MATERIAL,
Washington Univ., Seattle. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W86-02453

MEASUREMENT OF LOW FLOW VELOCITIES FOR SHALLOW BODIES OF WATER,
Vermont Univ., Burlington. Dept. of Civil and Mechanical Engineering.
For primary bibliographic entry see Field 7B.
W86-02459

INSTREAM FLOW NEEDS IN CRITICAL AREAS OF THE GREAT LAKES REGION,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
N. R. Kevern, C. Gowan, R. Wallace, and J. T. Pawloski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214641/AS, Price codes: A08 in paper copy, A01 in microfiche. Project Completion Report, Michigan Institute of Water Research, East Lansing (1984). 105 p, 22 fig, 6 tab, 15 ref. USGS G849-04.

Descriptors: *Michigan, *Water demand, Model studies, *Stream fisheries, *Instream water use, *Streamflow forecasting, *Instream flow, Habitat, Brown trout, Irrigation demand.

The Instream Flow Incremental Methodology (IFIM) was utilized for the first time in a Michigan stream. The objective was to test the method's applicability to the midwest, and to detail the impacts of irrigation withdrawals on a typical Lower Michigan marginal trout stream. The IFIM was found to be able to accurately simulate the hydraulic characteristics of a midwestern stream, and to be able to predict brown trout Salmo trutta habitat locations within the stream. Brown trout habitat losses were most critical in the month of July, with reductions of up to 19 percent. A greater percentage of the remaining fish experienced negative growth rates as reduced habitat availability. Benthic macroinvertebrate habitat was less impacted by irrigation withdrawals. Habitat losses for Hydropsyche sp. and Ephemerella sp. reached a maximum of 11.05 and 6.35 percent respectively during irrigation periods in July of 1983. This study describes a method for assessing the impacts of withdrawing water from the stream channel for crop irrigation. Monthly irrigation demands are estimated and added to measured streamflow to determine the natural streamflow. Natural streamflow is correlated with flow on a nearby watershed to develop an extensive series of monthly flows. Reduced flows under several levels of irrigation usage were determined. The procedure produces probability distributions for average monthly flow for each month of the growing season, for each irrigation level of usage. These results may be combined with habitat flow relationships developed with the incremental Flow Methodology to determine habitat reduction which would result from water withdrawals.
W86-02468

PHYSICAL MODEL STUDIES TO VERIFY A NUMERICAL MODEL OF FLOOD ROUTING,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
N. Kabir, and J. F. Orsborn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214831, Price codes: A07 in paper copy, A01 in microfiche. Technical Completion Report, Washington Water Resources Research Institute, Pullman, August, 1984. 116 p, 63 fig, 3 tab, 31 ref. USGS G876-06.

Descriptors: *Flood routing, *Flood forecasting, Flood flow, Flood hydrographs, *Computer models, Finite difference model, Mathematical studies, Channel flow, Unsteady flow, Simulation, *Washington.

A numerical model has been developed to simulate flood flows in a natural channel. The mathematical model utilizes a modified form of the complete equations of continuity and momentum for the unsteady open channel flow to include the off-channel storage area with no significant longitudinal flow. A four-point implicit finite difference scheme was used for solving the non-linear governing equations numerically in the dimensionless form. Model performance was evaluated by comparing numerical solutions with the data collected from laboratory experiments. The agreement between the simulated solutions and the experimental data was satisfactory. For a given flood, dimensionless peak flowrate and depth, and their time of arrival at any location along a reach are determined by the controlling parameters related to the channel geometry and flood hydrograph. A series of solution graphs were prepared from numerical experiments performed to investigate the effects of the controlling parameters on the propagation of a flood wave in the downstream direction along the length of a channel. These solution graphs can be used for flood forecasting.
W86-02486

CONTINUOUS SYNTHESIS OF RUNOFF FROM THE KAWISHIWI RIVER IN NORTHEASTERN MINNESOTA,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
J. W. Toso, and C. E. Bowers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215150/AS, Price codes: A08 in paper copy, A01 in microfiche. Technical Completion Report, Minnesota Water Resources Research Center, Minneapolis, 1983. 147 p, 18 tab, 60 fig. B-161-MINN(1). 14-34-0001-1237.

Descriptors: *Mathematical model, *Hydrologic model, *Floods, *Minnesota, SSARR, Simulation models, Flood forecasting, Rainfall-runoff relationships, *Water quality forecasting.

A mathematical simulation model (SSARR) will compute flows at selected points in the system for use with water quality data. Initial input to the SSARR consists of data concerning (1) watershed areas, (2) storage-outflow for lake/reservoirs, (3) monthly evapotranspiration, (4) routing data, and (5) selected coefficients. Using past observed flows, curves are fitted for (1) Soil Moisture Index versus Percent Runoff, (2) Baseflow Infiltration versus Baseflow Percent, and (3) Moisture Input Rate as a function of the Surface Runoff Component, and (4) Melt Rate per Degree-Day. Following the fitting process, temperature and precipita-

tion data are input for the desired period, plus an initial Soil Moisture Index. The model then computes the flow and lake levels at sixteen locations on a continuous synthesis basis. Runs with up to eighteen monthly in length have been made in this study. The SSARR has two basic modes of operation, (1) the split basin and (2) the snow band option. The model was fitted with the first option in an earlier study. The second option was used in the current study. Good results were obtained with the second or snow band option. This is the option recommended for future use in the Kawishiwi Basin. The SSARR is an excellent continuous synthesis model. It has performed very well in both the agricultural and forested regions of Minnesota. The input data format could be improved and additional control options at the dams may be desirable.
W86-02518

MATHEMATICAL MODELS FOR UNGAGED WATERSHEDS WITH POTENTIAL FOR QUANTIFYING THE EFFECT OF LAND USE CHANGES ON STREAMFLOW,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W86-02548

ENHANCEMENT OF DURATION CURVE PREDICTION USING SHORT TIME LOW FLOW MEASUREMENTS,
Idaho Univ., Moscow. Coll. of Engineering.
L. F. Heitz, and J. R. Filler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249118/AS, Price codes: A06 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, Moscow, Completion Report, May, 1984, 102 p, 18 fig, 15 tab, 47 ref. USGS G839-08. 14-08-0001-G839.

Descriptors: *Idaho, Statistical methods, *Streamflow forecasting, Stream discharge, Flow duration, *Low flow.

An analysis is presented of the year-to-year and day-to-day variation of low-flow stream discharge used in small-scale hydroelectric power projects. Primary use was made of flow duration procedures. Past streamflow gaging records were used to evaluate the variation over time as well as the variation of simultaneous measurements at different sites. Methodologies were developed for determing the low flow percentage exceedance values at an ungaged site using a single streamflow measurement coupled with knowing the exceedance percentages of gaged streamflow sites in the area. A major contribution of this methodology is a means of estimating the confidence bounds of the estimates made. The report also includes a number of field measurements of unregulated streams in northern Idaho for which interest in hydropower development has been shown or where streams were thought to be indicators of smaller basin behavior.
W86-02690

LOW FLOW HYDRAULICS IN ALLUVIAL CHANNELS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W86-02698

DIFFUSION AND ADVECTION IN TWO-DIMENSIONAL ROTATING FLOW,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
V. Alavian, and S. M. Broeren.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249670/AS, Price codes: A03 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana-Champaign, Research Report No 191, October 1984. 28 p, 6 fig, 24 ref. USGS G840-02. 14-08-0001-G840.

Descriptors: *Mass transport, *Mixing, Flow pattern, Circulating flow, Shear flow, *Dispersion, *Diffusion, *Finite element analysis, Fluid mechanics.

This paper presents the results of an investigation of mass transport by diffusion and advection in two-dimensional steady, spatially varied confined flow. In practice, this type of flow occurs in recirculating regions of streams and rivers or behind hydraulic structures. A simple vorticity transport model is used to simulate shear-induced flow in a square region confined on three sides and open to a uniform flow on one side. The differential equation governing diffusion and advection of a known quantity of tracer mass introduced in such flow is solved. The solution scheme is based on Galerkin finite element approximation of the transport equation. Diffusion is represented by a second-order tensor, the components of which are related to the eddy diffusion coefficient, as well as the magnitude and direction of the mean local velocity. The unsteady transport term is approximated by implicit finite differencing in time. Simulation results are given for one and two-dimensional test cases and for shear induced rotating flow.
W86-02699

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1983, VOLUME 4. NORTHERN CALIFORNIA VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE,
Geological Survey, Sacramento, CA. Water Resources Div.
R. P. Fogelman, J. R. Mullen, W. F. Shelton, R. G. Simpson, and D. A. Grillo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-225127, Price codes: A16 in paper copy, A01 in microfiche. USGS Water-Data Report CA-83-4, 1985. 361 p, 12 fig. Prepared in cooperation with the California Department of Water Resources and with other agencies.

Descriptors: *California, *Hydrologic data, *Surface water, *Water quality, *Groundwater, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediment, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for California consists of records of stage, discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water quality in wells. Volume 4 contains discharge records for 153 gaging stations; stage and contents for 25 lakes and reservoirs; precipitation data for 2 stations; water quality for 7 stations; and water levels for 147 observation wells. Also included is one low-flow partial-record station. Additional water data are collected at various sites, not part of the systematic data-collection program, and are published as special investigations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (USGS)
W86-02771

WATER RESOURCES DATA FOR CALIFORNIA, 1983, VOLUME 3. SOUTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM WALKER RIVER TO TRUCKEE RIVER,
Geological Survey, Sacramento, CA. Water Resources Div.
R. P. Fogelman, T. C. Hunter, J. R. Mullen, R. G. Simpson, and D. A. Grillo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-223726, Price codes: A17 in paper copy, A01 in microfiche. USGS Water-Data Report CA-83-3, 1985. 393 p, 12 fig.

Descriptors: *California, *Hydrologic data, *Surface water, *Water quality, *Groundwater, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediment, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for California consists of records of stage, discharge, gage-height, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and quality of water in wells. Volume 3 contains discharge records for 159 gaging stations; stage and contents for 41 lakes and reservoirs; gage height records for two lakes; water quality for 6 streams and 46 wells; and water levels for 99 observation wells. Also included are 11 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (USGS)
W86-02772

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02773

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NORTHEASTERN CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02774

MEASUREMENT OF DISCHARGE USING TRACERS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-02776

POTENTIAL SEEPAGE LOSSES IN AN ALLUVIAL CHANNEL--RIO GRANDE BASIN BETWEEN COCHITI DAM AND ELEPHANT BUTTE RESERVOIR, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2A.
W86-02779

TECHNIQUES FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS ON STREAMS IN INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
D. R. Glatfelter.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water Resources-Investigations Report 84-4134, 1984. 110 p, 10 fig, 10 tab, 16 ref.

Descriptors: *Flood frequency, *Flood peak, *Rainfall-runoff relationships, *Regional analysis, *Regression analysis, Flood recurrence interval, Frequency analysis, *Indiana, Model studies, Regulated flow, Small watersheds, Statistical analysis, Stream discharge, Basin characteristics, Synthesis of discharge, *Wabash river.

Equations for estimating the magnitude and frequency of floods on ungaged streams in Indiana were developed by multiple-regression analysis of basin characteristics and peak-flow statistical data from 242 gaged sites in Indiana, Ohio, and Illinois. The state of Indiana was divided into seven areas on the basis of regression analysis. A set of equations for estimating peak discharges with recurrence intervals of 2, 10, 25, 50, and 100 years was developed for each area. The equations are valid for unregulated and nonurban streams. Significant basin characteristics in the equations are drainage area, channel length, channel slope, mean annual precipitation, intensity of precipitation, storage, and a runoff coefficient. Standard errors of estimate for the equations range from 24 to 45 percent. A rainfall-runoff model was used to extend the length of record at 11 gaged sites on small streams. Flood-frequency data from the synthetic peaks and from the observed peaks were combined by weighting techniques. (USGS)
W86-02780

COST EFFECTIVENESS OF THE U.S. GEOLOGICAL SURVEY'S STREAM-GAGING PROGRAM IN ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02782

LOW-FLOW CHARACTERISTICS OF STREAMS IN THE KISHWAUKEE RIVER BASIN, ILLINOIS,
Geological Survey, De Kalb, IL. Water Resources Div.
H. E. Allen, and E. A. Cowan.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water Resources Investigations Report 84-4311, 1985. 35 p, 9 fig, 7 tab, 16 ref.

Descriptors: *Flow characteristics, *Low flow, *Base flow, Streamflow, Forecasting, Wastewater discharge, Channel storage, Groundwater storage, Statistical analysis, Regression analysis, Frequency distribution, *Illinois, *Kishwaukee River basin, Streamflow-recession index.

Seven-day, 2-year, and 7-day, 10-year natural low flows are estimated at five continuous-record gaging stations based on streamflow records and records of wastewater effluent furnished by treatment plants. Low flows are also estimated at 22 partial-record stations by relating natural low-flow estimates for long-term stations to discharge measurements at partial-record stations. Standard error of estimates for the 27 gaged sites averaged 33 percent for 2-year estimates and 51 percent for 10-year estimates. A technique for estimating flows at ungaged stream sites is based on drainage area and indexes of streamflow recession. Streamflow-recession indexes were used to account for effects of geology on low flows. Multiple-regression analyses relates the low flows to drainage area and streamflow recession rates. Average standard errors of estimates of 61 and 97 percent were indicated for the 2-year and 10-year estimating equations, respectively. Wastewater treatment plant location and effluent discharged during 7-day low-flow periods in 1981 are presented for use in adjusting natural low-flow estimates at gaged and ungaged sites to represent 1981 streamflow conditions. (USGS)
W86-02787

RUNOFF AND CHEMICAL LOADING IN SMALL WATERSHEDS IN THE TWIN CITIES METROPOLITAN AREA, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
M. A. Ayers, R. G. Brown, and G. L. Oberts.
Available from: OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4122, 1985. 35 p, 1 fig, 6 tab, 15 ref.

Descriptors: *Runoff, Water quality, *Urban hydrology, *Urban runoff, *Water pollution sources, Storm runoff, *Twin Cities Metropolitan Area, *Minnesota.

Flow, rainfall, and water-quality data were collected during 1980 for 15 to 30 rainfall and snowmelt events on 6 rural and 11 urban watersheds in the Twin Cities Metropolitan Area. Event or daily flow and load models (for seven constituents) were developed and used with runoff and rainfall data for 1963-80 to compute 2-year frequency annual and seasonal flows and loads for each watershed. In models of storm-sewered watersheds, total storm rainfall proved to be the most significant factor controlling runoff and loads. Depending on the watershed type, antecedent soil-moisture indices and rainfall intensity also were important factors in estimating runoff. Annual runoff from storm-sewered watersheds averaged about 27 percent of annual precipitation, ranging from 13 to 57 percent. Runoff in urban main-stem streams ranged from 13 to 20 percent and was related to the percent of urbanization in the watershed. Annual runoff in rural watersheds ranged from 6 to 20 percent of annual precipitation. Runoff responses were highest in the snowmelt season for all watersheds and declined through the rest of the year. Rural watersheds showed a considerable decrease in runoff response during late summer and fall. Urban-watershed response from season to season was more consistent than rural watersheds because of the impervious area and storm sewers in urban watersheds. (USGS)
W86-02794

STREAMFLOW AND SPECIFIC-CONDUCTANCE DATA FOR SELECTED SITES, FEBRUARY 15 THROUGH APRIL 9, 1984, NEAR THE Y-12 PLANT, THE OAK RIDGE RESERVATION, TENNESSEE,
Geological Survey, Knoxville, TN. Water Resources Div.
R. D. Evaldi.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Hydrologic-Data Report OFR 84-625, 1984. 13 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Discharge measurement, *Specific conductance, *Stream discharge, Base flow, *Tennessee, *Oak Ridge Reservation, Y-12 Plant, Bear Creek, Clinch River.

Discharge and specific conductance were measured February 15 through April 9, 1984, during base flow of streams in 18 watersheds in the vicinity of the Y-12 Plant of the Oak Ridge Reservation, Tennessee. Discharge of springs and streams measured at specific sites ranged from 0 to 16 cubic feet per second. Specific conductance ranged from 23 to 6,300 micromhos per centimeter. During the days of instantaneous discharge measurements, flow of Bear Creek at the continuous-record station at Highway 95 near Oak Ridge ranged from 3.6 to 17 cubic feet per second. (USGS)
W86-02817

METHOD FOR ESTIMATING MEAN AND LOW FLOWS OF STREAMS IN NATIONAL FORESTS IN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
C. Parrett, and J. A. Hull.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4071, May 1985. 13 p, 1 fig, 5 tab, 5 ref.

Descriptors: Annual runoff, Regression analysis, *Estimating equations, *Mean flow, Gaging station, *Low flow, Active-channel width, Channel geometry, *Montana, National forests.

Equations were developed for estimating mean annual discharge, 80-percent exceedance discharge, and 95-percent exceedance discharge for streams on national forest lands in Montana. The equations for mean annual discharge used active-channel width, drainage area and mean annual precipitation as independent variables, with active-channel width being most significant. The equations for 80-percent exceedance discharge and 95-percent exceedance discharge used only active-channel width as an independent variable. The standard error or estimate for the best equation for estimating mean annual discharge was 27 percent. The standard errors of estimate for the equations were 67 percent for estimating 80-percent exceedance discharge and 75 percent for estimating 95-percent exceedance discharge. (USGS)
W86-02824

AVAILABILTY OF NATURAL AND REGULATED STREAMFLOWS FOR INSTREAM USES DURING HISTORICAL DROUGHTS, LOWER NEOSHO RIVER, SOUTHEASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
R. J. Hart, and T. C. Stiles.
Available from: OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4292, 1984. 42 p, 11 fig, 27 tab, 8 ref.

Descriptors: Natural flow, *Regulated flow, Reservoir operations, Reservoir storage, Hydrologic models, *Routing, *Instream use, *Streamflow, Water yield, *Lower Neosho River, John Redmond Reservoir, Iola, Parsons, Strawn, *Kansas.

The effects of three historical droughts on streamflows available for instream use on the lower Neosho River at Iola and Parsons, Kansas, were investigated. Natural streamflows that occurred during the three droughts were compared to the multiple-use and water-quality streamflows recommended by State agencies. A reservoir model was used to investigate the effects of John Redmond Reservoir on the natural streamflows. The regulated streamflow produced from the reservoir model then was compared to the multiple-use and water-quality streamflows. The regulated streamflows usually satisfied the multiple-use and water-quality streamflows more often than the natural streamflows. Frequency analysis made on the natural and regulated streamflows showed that the number of days of low flow (less than 30 cubic feet per second) were reduced by the regulated streamflows, which aided in the achievement of the multiple-use and water-quality streamflows goals. The reservoir model was used to determine if sufficient storage was available in John Redmond Reservoir to modify the natural streamflows in order to satisfy the multiple-use and water-quality streamflow recommendations. Additional storage of 15,400 acre-feet was estimated to be needed to maintain the multiple-use streamflows at Parsons. (USGS)
W86-02838

SELECTED CLIMATOLOGICAL AND HYDROLOGIC DATA, RATON BASIN, HUERFANO AND LAS ANIMAS COUNTIES, COLORADO, AND COLFAX COUNTY, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
A. L. Geldon, and P. O. Abbott.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-138, 1985. 268 p, 5 fig, 44 tab, 33 ref.

Descriptors: *Climatic data, *Hydrologic data, Surface water data, Groundwater data, Data collections, Coal mining, *Colorado, Las Animas County, Huerfano county, *New Mexico, Colfax County, *Raton Basin.

The hydrology of the coal-bearing Raton Basin of Colorado and New Mexico was investigated by the U.S. Geological Survey. Data in the report were collected from 1977 to 1982, mainly in the watersheds of the Apishapa and Purgatoire Rivers; data from the Cucharas, Canadian, and Vermejo River watersheds are also included in the report. The report contains records of precipitation, temperature, relative humidity, evaporation, and wind movement at U.S. Geological Survey and U.S. Army Corps of Engineers meteorological stations; records of soil water collected by the U.S. Geological Survey; records of stream discharge and quality at U.S. Geological Survey gaging stations and miscellaneous sites; and a variety of ground-water data. The ground-water data includes records of 231 wells, springs, and mines, including 87 chemical analyses of the water, recorded water levels in 29 observation wells, results of 125 aquifer tests, and 87 logs of wells and test holes. (USGS)
W86-02839

SPIRIT LAKE DAM-FAILURE FLOOD ROUTING ASSESSMENT,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-02846

VELOCITY PROFILE, WATER-SURFACE SLOPE, AND BED-MATERIAL SIZE FOR SELECTED STREAMS IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. P. Marchand, R. D. Jarrett, and L. L. Jones.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-733, 1984. 82 p, 18 fig, 4 tab, 21 ref.

Descriptors: *Current meters, *Velocity distribution, *Velocity curve, Streamflow, High-gradient streams, Mountain streams, Hydraulics, Flow measurement, Hydrologic data collections, Particle size, *Colorado.

Existing methods for determining the mean velocity in a vertical sampling section do not address the conditions present in high-gradient, shallow-depth streams common to mountainous regions such as Colorado. The report presents velocity-profile data that were collected for 11 streamflow-gaging stations in Colorado using both a standard Price type AA current meter and a prototype Price Model PAA current meter. Computational results are compiled that will enable mean velocities calculated from measurements by the two current meters to be compared with each other and with existing methods for determining mean velocity. Water-surface slope, bed-material size, and flow-characteristic data for the 11 sites studied also are presented. (USGS)
W86-02852

SYNTHESIZED FLOOD FREQUENCY OF URBAN STREAMS IN ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02856

MAGNITUDE AND FREQUENCY OF FLOODS IN ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
D. A. Olin.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4191, 1984. 105 p, 24 fig, 9 tab, 16 ref.

Descriptors: *Floods, *Frequency analysis, Surface water, *Regression analysis, *Flood frequency, Flood recurrence interval, Statistical methods, *Alabama.

Methods are presented to estimate flood magnitude for selected recurrence intervals for urban and rural streams with drainage areas from 1 to 22,000 square miles. Seven hydrologic areas were delineated and regression equations were developed for six areas. Hydrologic data could not be regionalized for the seventh area. Drainage area was the only independent variable used in the equations for five hydrologic areas. Drainage area and a storage factor were used in the equations for the other area. One hydrologic area, located in the central part of the State, has flood runoffs two to four times greater than the other areas. It is recommended that the rural equations be used for estimates of flood magnitudes for both urban and rural streams in the hydrologic area. Rivers with drainage areas greater than 1,500 square miles could not be regionalized. Estimating methods for these rivers are shown graphically. Maximum flood magnitudes versus drainage area also are presented. (USGS)
W86-02857

ESTIMATION OF THE FLOW AND WATER-QUALITY CHARACTERISTICS OF ALASKAN STREAMS,
Geological Survey, Fairbanks, AK. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-02864

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN KANSAS--FISCAL YEARS 1983 AND 1984,
Geological Survey, Lawrence, KS. Water Resources Div.
L. J. Combs.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-178, 1985. 97 p, 10 fig, 6 tab.

Descriptors: *Groundwater, Aquifers, *Streamflow, *Water quality, *Kansas, *Hydrologic data, Data collections.

The principal mission of the U.S. Geological Survey, Water Resources Division, in Kansas is to investigate the occurrence, quantity, quality, distribution, and movement of surface and ground waters throughout the State. Primary activities include the systematic collection, analysis, and interpretation of hydrologic data, evaluation of water demands, and water-resources research. Hydrologic investigations are conducted through four basic types of projects: (1) data-collection programs, (2) local or areal investigations, (3) statewide or regional investigations, and (4) research projects. These projects are funded through cooperative agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal funds. Fifty water-related projects were ongoing during fiscal years 1983 and 1984 in Kansas. This report describes for each of these water-resources activities the problem that initiated the study, the objectives of the project, and the approach designed to achieve these objectives. Information on data-collection stations in Kansas is presented in maps and tables. A list of the 40 reports approved for publication by the U.S. Geological Survey, its cooperators, or technical and scientific organizations during 1983 and 1984 is provided. (USGS)
W86-02865

EFFECTS OF RELOCATING STATE ROUTE 151 ON THE FLOOD PROFILES OF CONOTTON CREEK AND ITS TRIBUTARIES BETWEEN BOWERSTON AND SCIO, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02872

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02885

SUMMARY OF WATER RESOURCES DEVELOPMENT AND HYDROLOGIC DATA OF SAIPAN, MARIANA ISLANDS,
Geological Survey, Honolulu, HI. Water Resources Div.
O. Van der Brug.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4121, 1985. 578 p, 35 fig, 77 tab, 48 ref.

Descriptors: *Water-resources development, *Hydrologic data, Weather data, Pacific Islands, *Mariana Islands, *Saipan, Data collections.

Saipan is the largest island of the Northern Mariana Islands, a chain of 14 islands north of Guam. Saipan comprises one third of the land area of the islands. No long-term rainfall record is available at any location, but some rainfall records are for periods up to 16 years, some of which began in 1901. Average annual rainfall for the island is 81 inches, with the southern end receiving about 10 inches less annually than the rest of the island. The amount of rainfall which runs off in northeast Saipan ranges from 23 to 64 percent and averages about 40 percent. Runoff on the rest of the island is from springs or occurs only during heavy rainfall. Surface-water development appears impractical. Ground water is the main source of water for the island and production was almost 4 million gallons per day in 1982. However, chloride concentration in ground water exceeds 1,000 milligrams per liter in many locations. The average chloride concentration of the domestic water stays near the maximum permissible level (600 milligrams per liter). This report summarizes the history of the water-resources development and presents all available hydrologic data, including rainfall records since 1901, streamflow records since 1968, and drilling logs, pumping tests, chemical analyses, and production figures from 180 testholes and wells drilled on Saipan. (USGS)
W86-02887

SUMMARY OF STATISTICAL AND TREND ANALYSES OF SELECTED WATER-QUALITY DATA COLLECTED NEAR THE BIG THICKET NATIONAL PRESERVE, SOUTHEAST TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02893

PRELIMINARY REPORT ON A STUDY TO ESTIMATE FLOOD VOLUMES OF SMALL RURAL STREAMS IN OHIO: METHODS, SITE SELECTION, AND DATA BASE,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02906

PENNSYLVANIA GAZETTEER OF STREAMS - PART II,
Geological Survey, Harrisburg, PA. Water Resources Div.
L. C. Shaw.
Available from OFSS, USGS Box 25425, Lakewood, CO 80225. Bulletin No. 16. 300 p, 32 fig, 2 ref.

Descriptors: *Streams, *Pennsylvania, *Hydrologic data, *Drainage area, *Drainage pattern, Channel pattern, Main channel, Stream length, Meander ratio, Relief ratio, Channel slope, Geomorphology, Water data, Data collections, *Hydrologic unit maps.

The Pennsylvania Gazetteer of Streams, Part II, contains detailed descriptions of 571 streams with drainage areas greater than 25 square miles. Natural resources, natural, artificial, and hydrologic features describe the basin. Planners, water users, and water managers will be able to better utilize the basin's physical and hydrological information to prepare an effective ecological evaluation. (USGS)
W86-02907

BASE-FLOW CHARACTERISTICS OF SEGMENTS OF THE PINEY RIVER, AND EAST AND WEST PINEY RIVERS, DICKSON AND HICKMAN COUNTIES, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
V. J. May.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-155, 1985. 19 p, 8 fig, 4 tab, 10 ref.

Descriptors: *Baseflow, *Seepage, *Drought, *Flow profiles, *Frequency analysis, Discharge measurement, *Tennessee, Piney River, Dickson County, Hickman County.

Base-flow profiles based on discharge measurements made during a seepage investigation on August 28, 1984, define losing and gaining reaches of segments of the Piney River, and East and West Piney Rivers, Dickson and Hickman Counties, central Tennessee. A similar profile defines losing and gaining reaches for the average 3-day minimum discharge, 20-year recurrence interval, and the variability of that discharge along the river channels. The average 3-day minimum discharge, 20-year recurrence interval, ranged from 2.4 cubic feet per second for the site on East Piney River to 45.6 cubic feet per second at the Vernon gage, farthest site downstream in the study area. On the Piney River, the lowest 3-day, 20-year discharge, occurs at river mile 23.5, 0.1 river mile downstream from the confluence of the East and West Piney Rivers. Comparison of discharge measurements to recorded August discharges at the Vernon gage shows that the measurements represent base-flow conditions in the Piney River basin. The measurements and analyses can be used to formulate water management plans for use during droughts. (USGS)
W86-02910

STREAMFLOW AND SEDIMENT DATA COLLECTED AT SEVEN STREAM-GAGING STATIONS IN THE JAMES RIVER BASIN DOWNSTREAM FROM FORESTBURG, SOUTH DAKOTA, FROM OCT 1, 1982 - SEP 30, 1983,
Geological Survey, Huron, SD. Water Resources Div.
J. R. Little.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-156, 1985. 60 p, 23 fig, 15 tab, 2 ref.

Descriptors: *Data collection, Hydrologic data, *Streamflow data, *Sediment data, *South Dakota, James River basin, Forestburg.

A compilation of streamflow and suspended-sediment data collected from October 1, 1982, to September 30, 1983, at seven gaging stations in the James River basin downstream from Forestburg, South Dakota, is presented in tabular and graphic form. Three of the gaging stations are on the main stem and four are on tributary streams. These are the results from the second year of a two-year study in cooperation with the Lower James Conservancy Sub-District. The data listed in the tables and figures include location, a summary of the streamflow for the period of record, tables listing the daily streamflow, mean suspended-sediment concentration, and suspended-sediment discharge; and figures showing the daily streamflow, mean suspended-sediment concentration and suspended-sediment discharge for each gaging station. Sandbars are developing in the river and this data is to be used in studies analyzing sources of the sediment and tributary sediment loads relative to those carried by the main stem. (USGS)
W86-02912

HARMONIC ANALYSES OF STREAM TEMPERATURES IN THE UPPER COLORADO RIVER BASIN,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7 .
W86-02917

2F. Groundwater

UTILIZATION OF THERMAL EMITTANCE DATA TO MONITOR SOIL MOISTURE AND SUBSURFACE GROUNDWATER,
South Dakota State Univ., Brookings. Dept. of Physics.
J. A. Tunheim, and W. W. Hein.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-203966/AS, Price codes: A06 in paper copy, A01 in microfiche. South Dakota Water Resources Research Institute, Brookings, Completion Report, Feb 1985, 110 p, 9 tab, 45 fig, 41 ref. Bu Rec B-068-SDAK. 14-34-0001-1263.

Descriptors: *Soil moisture, *Thermography, *Thermal prospecting, *Groundwater, Soil temperature, *Remote sensing, *South Dakota, Irrigation effects, Satellites.

Experimental and theoretical investigations were carried out relating to the detection and mapping of soil moisture and subsurface groundwater by the use of remote sensed thermal emmittance data (thermography). Calculations performed employing a previously developed finite difference model showed a quadratic relationship between temperature difference between two soil plots and their corresponding soil moisture difference. The relationship between the surface soil heat flux and calculated maximum diurnal temperature difference was found to be linear. Modifications of the model were also made to siimulate light penetration through the plant canopy. Experimental investigations consisted of measurements on both small controlled plots and over large land areas. Statistical analysis of small plot data showed a significant correlation between soil moisture differences between irrigated and nonirrigated plots and apparent surface temperature differences. Soil moisture and other measurements made throughout the state of South Dakota gave only marginal correlations with satellite thermal emmittance data. However, model calculations of apparent surface temperature differences agree well with satellite values. General results of this study indicate promise for use of satellite thermal emittance data in determining soil moisture but further study is needed.
W86-02429

GROUNDWATER QUALITY AND MINERAL DEPOSITS RELATIONSHIPS IN THE OZARK MOUNTAINS,
Arkansas Univ., Fayetteville. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W86-02448

UNIFIED MASS TRANSPORT MODEL FOR HIGH AND LOW GROUNDWATER DISPERSIVITIES,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-02467

FINITE ELEMENT SIMULATION OF SATURATED-UNSATURATED SUBSURFACE FLOW,
Kentucky Water Resources Research Inst., Lexington.
G. E. Blandford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214658/AS, Price codes: A04 in paper copy, A01 in microfiche. Research Report No 155, August 1984. 71 p, 13 fig, 34 ref. USGS G-844-03.

Descriptors: Mathematical models, Model studies, Saturated flow, Unsaturated flow, Storm seepage, Finite element method, *Groundwater movement, *Infiltration, *Surface-groundwater relationships.

A two-dimensional transient model for flow through saturate-unsaturated porous media is developed. The model numerically solves the pressure head dependent or moisture content dependent form of Richard's equation. The model code uses isoparametric quadratic triangular and/or quadrilateral finite elements for the geometric representation and for the weak Galerkin spacial integrations. An implicit, unconditionally stable single-step numerical time integration scheme with an oscillatory noise reduction option is utilized for the temporal discretization. The highly efficient symmetric skyline (profile) solution scheme is used to solve the resulting simultaneous equations. The nonlinear subsurface flow parameters are approximated using cubic spline interpolation. The element material properties can be independently defined thus permitting the modelling of layered geologic formations. Derivative smoothing is presented for the post-calculation of Darcian velocities. Currently, the program is limited to time varying specification of pressure head or moisture content and fluxes. Several sample problems are presented illustrating the accuracy and validity of the developed model.
W86-02469

DISCHARGE AND TRAVEL TIME DETERMINATIONS IN THE ROYAL SPRING GROUNDWATER BASIN, KENTUCKY,
Kentucky Water Resources Research Inst., Lexington.
J. Thrailkill, and D. R. Gouzie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214765/AS, Price codes: A04 in paper copy, A01 in microfiche. Research Report No. 149, August, 1984. 49 p, 7 fig, 6 tab, 14 ref. USGS G-844-07.

Descriptors: Dyes, *Karst hydrogeology, Groundwater basins, Dye releases, Groundwater movement, Groundwater pollution, Aquifiers, Karst, Limestone, Springs, *Kentucky.

Groundwater flow in many karst regions, including the Inner Bluegrass Karst Region of central Kentucky in which the study area was located, is unlike groundwater flow in granular aquifers. At least the major flows are turbulent and often with a free surface in large conduits, and applying concepts based on Darcy's Law to describe and model these flows is inappropriate. Parameters such as linear velocity, channel geometry, and conveyance used to describe surface streamflows are more applicable, and the primary objective of the project was to estimate these in a groundwater basin using the travel time of dye slugs and discharges obtained by dye dilution. These data were also needed to determine the travel time-discharge relationship required to manage contaminent-spills and evaluate methods of enhancing low flows in the basin, the second and third objective of the project. These latter two objectives are of importance because the flow in the Royal Spring groundwater basin that was investigated is used as a municipal water supply. Preliminary results indicate that the data will permit such parameter estimation and have suggested methods of increasing the amount of water available during low-flow periods.
W86-02479

MATHEMATICAL MODELS FOR WATER RESOURCES POLICY AND MANAGEMENT WITH APPLICATION TO THE EUTAW-MCSHAN AQUIFER,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
V. L. Zitta, and R. L. Frnka.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214914/AS, Price codes: A07 in paper copy, A01 in microfiche. Mississippi Water Resources Research Institute, Mississippi State, Technical Completion Report, September 1984, 133 p, 33 fig, 23 tab, 57 ref, 2 append. USGA G-851-03.

Descriptors: *Mississippi, *Groundwater movement, *Mathematical models, *Management planning, *Simulation analysis, Groundwater management, Water management, Unconfined aquifers, Confined aquifers.

This study sets forth a set of models for the simulation of groundwater flow in confined or unconfined aquifers along with optimization methods for the purpose of facilitating the work of the water manager. In particular the procedure contains routines for simulation of hydraulic head within the aquifer, power for transport of water from well source to demand center, unit cost of transport/treatment alternatives and well field development, and optimization of the many possible source locations with the demand centers. Application of the models was made to a hypothetical scenario of well fields and demand centers within the Eutaw-McShan aquifer in Mississippi. Twenty-six possible well field locations were to serve nine demand centers. Unit costs were computed and the optimum alternatives were determined from the Out-of-Kilter algorithm. A major part of the effort was to automate the procedures to input aquifer, well location and demand centers into the groundwater and transport, cost and optimization models. The model grid, county boundaries, aquifer outcrop areas, top and bottom elevations of the aquifer along with the well/demand centers were digitized and all geometric data transferred from longitude and latitude to state plane coordinates. All major plots were produced by software written for implementation on the MSU Computing Center equipment.
W86-02494

SUITABILITY OF MARINE CLAYS AS LINERS FOR HAZARDOUS WASTE DISPOSAL SITES,
Maine Univ. at Orono. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W86-02516

PARAMETER IDENTIFICATION IN LAYERED AQUIFER SYSTEMS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
M. Aral, and M. Zakihani.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216935/AS, Price codes: A05 in paper copy, A01 in micro-

fiche. Environmental Resources Center Report No. ERC-02-84, Georgia Institute of Technology, Atlanta, July, 1984, 73 p, 1 tab, 2 fig, 59 ref. USGS G-836(02).

Descriptors: *Groundwater movement, Model studies, *Groundwater seepage, *Finite element method, *Multilayer aquifers, Aquifer parameters, Geohydrology.

In this study, the finite element least squares optimization algorithm is utilized to identify the hydrogeologic field parameters of a multilayer aquifer system. The techniques developed rely on accurate steady-state piezometric head data for each aquifer in the multilayered system. The Least squares iterative approach developed systematically adjusts the local transmissivity values and the resistance prameters of the confining layers until a good fit is achieved between the observed and computed piezometric head values at several locations. This is an iterative approach which automates the trail and error model calibration process and extends it to a multilayer system. The technique is applied to a field problem with considerable success and the algorithm shows promise as a practical tool and a definite alternative to the manual trial and error approach.
W86-02524

STUDY OF THE MECHANICS OF GROUNDWATER AQUIFER/AQUITARD EXPANSION CAUSED BY HEATING,
Auburn Univ., AL. Dept. of Civil Engineering.
R. K. Moore, and D. R. Hampton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-219061/AS, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, Alabama Water Resources Research Institute, Auburn, September 1984. 51 p, 27 ref, 12 fig, 3 tab. USGS G880-06.

Descriptors: *Thermal storage, *Alabama, *Aquifers, *Temperature effects, Subsidence, Heave, Computer modeling.

FORTRAN computer models were developed to predict the expansion and contraction of aquifers bounded by upper and lower aquitards caused by injection-storage-retrieval cycles associated with aquifer storage and recovery of thermal energy. The model is based on four volume change components: (1) reversible volume change caused by temperature change (2) irreversible volume change caused by temperature change (3) volume change caused by decrease in effective stress in an undrained geotechnical material and (4) dissipation of excess pore pressure through a consolidation process. The computer results were compared to field observations obtained from a thermal energy-aquifer storage demonstration experiment in Mobile, Alabama. The computer model over-predicts surface heave in the early portion of the injection cycle, but satisfactorily approximates the field observations during the last half of the total injection-storage-recovery cycle. The error may be associated with the simplified approach assumed to model the time-dependent consolidation/drainage process.
W86-02553

SINGLE-WELL, MULTIPLE-PULSE TRACER TECHNIQUE FOR ESTIMATING GROUND WATER VELOCITIES AND POLLUANT TRANSPORT RATES: THEORETICAL DEVELOPMENT,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W86-02560

GROUNDWATER PROBLEMS IN THE MID-ATLANTIC FALL-LINE CITIES,
District of Columbia Univ., Washington. Water Resources Research Center.
M. H. Watt, and J. V. O'Connor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225985/AS, Price codes: A05 in paper copy, A01 in microfiche. Report No. 62, September 1984. 70 p, 11 tab, 8 fig. USGS G834-02.

Descriptors: *Groundwater, Pollution, Urbanization, *Urban hydrology, *Dewatering, Wells, Construction, Groundwater management, Hydrogeology, Building foundations, Fall Zone, Groundwater recharge, Groundwater laws, Oil seepage, Mid-Atlantic, District of Columbia.

In recent years, researchers and managers in the northeastern United States have focused most of their efforts on groundwater problems such as contamination and overdraft. However, little attention has been given to the groundwater regime of the major cities of the Fall Zone. The Fall Zone is a dividing zone between the Piedmont province and the Atlantic Coastal Plain province in the East Coast of the United States. The Fall Zone extends from New York to Georgia. The cities that lie along the Fall Zone are referred to as Fall-Line cities (e.g., Philadelphia, Wilmington, Baltimore, Washington, and Richmond). Here are a number of problems related to groundwater underlying urban areas. These are related to the construction, tunneling, and history of land use activities. The purpose of this project is to develop an understanding of the groundwater situation of the Fall-Line cities. The project examines groundwater quantity and quality of these cities. The impact of urbanization as well as institutional problems related to groundwater are discussed. Special emphasis was placed on the study of the District of Columbia's groundwater problems as they relate to construction, tunneling, and other urban activities.
W86-02574

TECTONIC STRUCTURES RESPONSIBLE FOR ANISOTROPIC TRANSMISSIVITIES IN THE PALEOZOIC AQUIFERS--SOUTHERN BIGHORN BASIN, WYOMING,
Wyoming Univ., Laramie. Coll. of Arts and Sciences.
D. L. Blackstone, and P. W. Huntoon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227155/AS, Price codes: A05 in paper copy, A01 in microfiche. Wyoming Water Research Center, Technical Completion Report, Laramie, September 1984. 84 p, 35 fig, 3 tab, 92 ref, append. USGS G879-02.

Descriptors: *Wyoming, *Structural geology; *Groundwater movement, *Anisotropy, Groundwater, Permeability, Drilling fluids, Oil wells, Aquifer characteristics, *Pennsylvanian Tensleep, *Bighorn Basin.

A structure contour map datum on top of the Pennsylvanian Tensleep sandstone aquifer was drafted by the Wyoming Geological Survey. The map covers approximately 7,200 square miles in the southern Bighorn Basin, Wyoming including Washakie and Hot Springs Counties and parts of Fremont, Park and Bighorn Counties; scale 1:125,000. Regional cross sections are included; scale 1" = 1 mile. Specific detailed cross sections for 20 anticlinal structures are completed. All available surface geology, well data and reflection seismic lines have been utilized. The emphasis is on the disruption of the aquifer by folding and faulting (anisotropy); scale 1:24,000.
W86-02582

ANALYSIS OF INJECTION IN STRATIFIED AQUIFERS,
Florida Univ., Gainesville. Dept. of Civil Engineering.
S. J. Laux, and B. A. Benedict.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227247/AS, Price codes: A05 in paper copy, A01 in microfiche. Florida Water Resources Research Center, Gainesville, Publication No. 81, Aug. 1984. 79 p, 10 fig, 2 tab, 43 ref, append. USGS G835-02.

Descriptors: Groundwater, Modeling, Water quality, *Injection wells, *Florida, Finite element method, Saline-freshwater interfaces.

An extension of the integral method was made to model the case of injection into a two-layer system with injection into the top of the lower layer. An alternating direction implicit (ADI) finite-difference model was developed to solve the equations describing this system. The need for small time steps for model convergence and the rapid stabilization of drawdowns led to the alternative use of an analytical method (the Hantush equation for leaky aquifers) to calculate drawdowns and drastically reduce computer time. Attempts were made to fit the model to data from injection wells in Pinellas County, Florida. The basic extent of the injected water field was reproduced fairly well, except that the drawdown and injected water thickness in the immediate vicinity of the well are too small. Neglect of vertical flows in the well region may be of importance here. The complicated system here, with salt water both above and below the injected water, makes it difficult to estimate well concentrations currently. The model developed in this work produces a tool for analysis of injections of wastes which should prove useful for preliminary assessments. Work is continuing to further the development and test against other data.
W86-02589

ISOTOPIC INVESTIGATION OF GROUNDWATER RESOURCES IN THE OJO ALAMO SANDSTONE, NACIMENTO, AND SAN JOSE FORMATIONS, SAN JUAN BASIN, NEW MEXICO,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
F. M. Phillips, L. A. Peeters, and M. K. Tansey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-229805/AS, Price codes: A06 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institue, Technical Completion Report, Las Cruces, October 1984. 104 p, 17 fig, 9 tab, 88 ref, 2 append. USGS G-858-02.

Descriptors: *Groundwater resources, *New Mexico, Coal mining, Groundwater dating, Carbon radisotopes, Tritium, Deuterium, Oxygen isotopes, Paleoclimatology.

The San Juan Basin, in northwest New Mexico, has vast reserves of strippable, low sulfur coal. Development of this resources will require large quantities of water, from an area where water resources are not abundant. Since surface-water supplies are fully allocated, increased future water demands will have to be met through groundwater development. This study concentrates on the Ojo Alamo, Nacimiento, and San Jose Formations, the aquifers directly above the principal coal unit. Carbon-14 and tritium methods were used to date the ground water in these units. Initial radiocarbon activities were calculated using the models of Vogel, Tamers, Pearson, Mook and Fontes. Ages from Fontes' model, ranging from modern to 26,000 years, were used for hydraulic conductivity estimates, which varied from 3 X 10-7 m/sec to 10-5 m/sec. Tritum analyses showed that postbomb precipitation was present in samples with modern radiocarbon dates, indicating that active recharge is occurring. Stable isotope results showed a clear correlation between ground-water age and stable-isotope concentrations. Samples with Pleistocene radiocarbon ages exhibited a significant depletion in deuterium and oxygen-18. This observation lends support to the hypothesis of isotopically lighter Pleistocene precipitation. Such lighter recharge was most likely due to a colder mean annual temperature and perhaps increased winter precipation. Consideration of various factors controlloing the stable isotope composition of ground water allows estimation of a 5 to 7 C temperature decrease during the late Wisconsin, accompanied by increased effective precipitation. A similar change is obtained from nobel-gas paleothermometry.
W86-02609

HYDROGEOLOGY OF DEKE ISLAND, PINGELAP ATOLL, EASTERN CAROLINE ISLANDS,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
J. F. Ayers, H. L. Vacher, R. N. Clayshulte, D.

Strout, and R. Stebnisky.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232809/AS, Price codes: A17 in paper copy, A01 in microfiche. Technical Report No. 52, July, 1984. 366 p, 49 fig, 19 tab, 13 ref. USGS G837-02.

Descriptors: *Guam, *Geohydrology, *Atolls, Groundwater, Groundwater movement, Reefs, Carbonates, Carbonate rocks, Limestones, Seismology, Geophysics.

An extensive hydrogeological investigation was conducted on Deke Island located on Pingelap Atoll, Ponape State. Field work included installation of observation wells, water-level monitoring, installation of a tidal gage, core drilling, surface geological and topographical mapping, geophysical surveys, and water-quality analysis. Results indicate a number of previously unknown aspects of atoll island hydrology. The most significant is the partial confinement of the fresh-water lens system beneath the landward extension of the reef-flat plate. Where the plate is absent water-table conditions are prevalent. The plate acts as a leaky confining layer which allows some rainwater to enter the flow system by downward movement under gravity. A method of reducing observed water levels in wells to actual sea level was developed. Also, several subsurface hydrogeologic units were identified and their roles within the overall hydrology of Deke were defined. In general, the size and extent of the lens was mapped. Based on the interpretation of study results, an atoll island hydrogeologic (conceptual) model is presented. Finally, some practical implications of the study findings are discussed and recommendations for further work are made.
W86-02625

CHARACTERIZING WATER MOVEMENT IN THE WEATHERED ZONE OF GLACIAL TILLS UNDER CONTINUOUS IRRIGATION,
South Dakota State Univ., Brookings. Water Resources Research Inst.
A. R. Bender, and C. G. Carlson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232817/AS, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, December, 1984. 26 p, 6 tab, 3 fig, 6 ref. USGS G-869-06. 14-08-0001-G-869.

Descriptors: *South Dakota, *Glacial till, *Hydraulic conductivity, *Porosity, Irrigation design.

A natural prairie site in Hyde County, South Dakota was instrumented and sprinkler irrigated to determine the hydraulic properties of the glacial till substrates. Sufficient water was added to the soil profile during a 40 day period to achieve static, saturated conditions with a water table at the surface. Water penetrated to at least 4.5 meters but less than 9 meters depth below the surface during the study period (9 months). Saturated hydraulic conductivities were calculated to be in the range .02-.03 cm/hr in the 1-3 meter layer. Drainable porosity was in the range of .03-.06 with .04-.05 being the most probable range in the 1-3 meter layer. Piezometers on the plots indicated a significant fall in the water table during the winter but the data was insufficient to verify the validity or meaning of these observations.
W86-02626

INDICATORS OF GROUND WATER QUALITY AND YIELD FOR A PUBLIC WATER SUPPLY IN ROCK FRACTURE ZONES OF THE PIEDMONT.
Clemson Univ., SC. Dept. of Chemistry and Geology.
D. S. Snipes, L. L. Burnett, J. A. Wylie, L. A. Sacks, and S. B. Heaton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233765/AS, Price codes: A05 in paper copy, A01 in microfiche. South Carolina Water Resources Research Institute Completion Report, No. 115, Clemson, August 1984. 80 p, 11 fig, 21 tab, 29 ref, 2 append. USGS, G-868-02. 14-08-0001-G-868.

Descriptors: *Well data, *Fracture permeability, *Magnetic studies, *South Carolina, Profiles, *Groundwater, Dikes, Metamorphic rocks, Igneous rocks, Granite, Water quality, Acidity, Yield, *Water yield.

This investigation deals with field and laboratory studies on indicators of ground water quality and well yields from a variety of igneous, metamorphic, and fault rocks situated in the Piedmont of South Carolina. The yields of 206 wells drilled in Greenwood County varied from 0 to 150 gpm, while the median was 17 gpm. The median yield of the wells situated in fracture traces and lineaments was 25 gpm, which was about twice the median yield of 12 gpm of the randomly located wells. The median productivity of the wells situated in the Carolina Slate Belt was 28 gpm, while the median yields of the Charlotte and Kings Mountain belts were 17 gpm and 15 gpm respectively. The higher productivity of the Carolina Slate Belt was caused by a greater abundance of permeable bedding planes and joints in these rocks. The principal water quality problem was the low pH. The median value was 6.4, and 25 percent of the samples had pH values below 6.0. The lowest median pH, 5.8, was reported from 9 wells drilled in the Coronaca Granite-Tyenite. Two new dikes, the Sholas Junction Dolerite of Greenwood County and the Due West Dolerite of Abbeville County, were mapped. Studies of magnetometer profiles and field data suggest that the Shoals Junction Dolerite consists of multiple dikes emplaced in extensional fractures which cut across rocks of the Kings Mountain Belt. Unfortunately, no drilled wells were located in the Shoals Junction Dolerite and thus, its ground water capability is not known. Nevertheless, because of the high incidence of fractures here, this zone might well contain good supplies of ground water.
W86-02654

CALIBRATION OF THE SNAKE PLAIN AQUIFER GROUND-WATER FLOW MODEL,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
G. S. Johnson, C. E. Brockway, and J. Lindgren.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249100/AS, Price codes: A02 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, Completion Report, Moscow, May, 1985. 10 p, 2 fig, 5 ref. USGS G839-06. 14-08-0001-G839.

Descriptors: *Idaho, Groundwater resources, Aquifer characteristics, Aquifer systems, Groundwater movement.

The Snake Plain aquifer ground-water flow model is operated by the Idaho Department of Water Resources as a tool for management of the aquifer and the hydraulically connected Snake River. Data made available by the 1980 U.S. Geological Survey RASA program is being used to recalibrate the model. This project provided technical assistance for the assembly and interpretation of the hydrologic data necessary to recalibrate the model.
W86-02689

FEASIBILITY OF DIRECT UTILIZATION OF SELECTED GEOTHERMAL WATER FOR AQUACULTURE OF MACROBRACHIUM ROSENBERGII.
Boise State Univ., ID. Dept. of Geology and Geophysics.
C. Spinosa.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249126/AS, Price codes: A03 in paper copy, A01 in microfiche. Idaho Water Research Institute, Moscow, Completion Report, May, 1984, 18 p, 3 fig, 2 tab, 15 ref, USGS G839-09. 14-08-0001-G839.

Descriptors: *Geothermal resources, *Idaho, *Aquaculture, Crustaceans, *Water quality, Groundwater, Commercial shellfish.

The feasibility was tested of direct utilization of geothermal water for the aquaculture of Malaysian freshwater prawns (Macrobrachium rosenbergii). A problem with using geothermal water for aquaculture is the chemical composition of the water with high flouride levels being a particular problem. Results show that (1) some geothermal water in Idaho can be used directly for the aquaculture of Macrobrachium rosenbergii, (2) high flouride levels cannot be directly correlated with high mortality rates and (3) low flouride levels do not correlate with high growth rates.
W86-02691

EVALUATION OF DATA REQUIREMENTS FOR GROUNDWATER CONTAMINANT TRANSPORT MODELING,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-02723

BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN NORTH-CENTRAL MISSISSIPPI, AUGUST 1984,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02761

WATER RESOURCES OF AURORA AND JERAULD COUNTIES, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02763

GROUND-WATER SYSTEM AND POSSIBLE EFFECTS OF UNDERGROUND COAL MINING IN THE TRAIL MOUNTAIN AREA, CENTRAL UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02765

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1983, VOLUME 4. NORTHERN CALIFORNIA VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02771

WATER RESOURCES DATA FOR CALIFORNIA, 1983, VOLUME 3. SOUTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM WALKER RIVER TO TRUCKEE RIVER,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02772

WATER-DATA PROGRAM OF THE U.S. GEOLOGICAL SURVEY IN KANSAS, FISCAL YEAR 1983,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02778

WATER-LEVEL DECLINES IN THE MAGOTHY AQUIFER IN SOUTHERN MARYLAND RELATED TO INCREASES IN PUMPAGE,
Maryland Dept. of Natural Resources, Annapolis.
F. K. Mack, J. C. Wheeler, and S. E. Curtin.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 82-919, 1983. 29 p, 13 fig, 3 tab, 13 ref.

Descriptors: *Groundwater, *Potentiometric level, Water wells, Coastal Plain, *Water-level fluctuations, Pumpage, Aquifer evaluation, Hydrographs, *Maryland, Charles County, Prince Georges County, Calvert County, *Magothy aquifer.

Pumpage from the Magothy aquifer in the project area in southern Maryland increased from about 0.45 million gallons per day (Mgal/d) in 1962 to about 3.3 Mgal/d in 1981. Distinct and extensive cones of depression developed in two parts of the project area: (1) localities surrounding the electric power generation plant at Chalk Point, in southeastern Prince Georges County, and (2) the rapidly developing Waldorf area of northern Charles. Hydrographs of daily values for water levels and pumpage data show several examples of the close relationship between pumpage and water levels. One shows that water levels rose one foot in an observation well as a result of the temporary termination of pumpage of 0.25 Mgal/d from a production well located 2-1/2 miles away. Pumpage from the Magothy aquifer in the Chalk Point area commenced in 1963 and stabilized at approximately 0.8 Mgal/d by 1975. Water levels declined as much as 61 feet by 1980. Pumpage from the Magothy aquifer in the Waldorf area commenced in 1948 and increased at a rather uniform rate to about 2 Mgal/d by 1980. Water levels declined about 85 feet in parts of the area during that period. (USGS)
W86-02781

WATER-QUALITY DATA FOR THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM IN SOUTHWESTERN NEW JERSEY, 1923-83,
Geological Survey, Trenton, NJ. Water Resources Div.
T. V. Fusillo, J. J. Hochreiter, and D. G. Lord.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-737, 1984. 127 p, 2 fig, 7 tab, 36 ref, 1 pl.

Descriptors: *Water quality, *Groundwater, *New Jersey, Unconsolidated aquifers, Inorganic compounds, Organic compounds, Water analysis, Well data, Coastal plain, Potomac-Raritan-Magothy aquifer system.

Water-quality data for wells in and near the outcrop area of the Potomac-Raritan-Magothy aquifer system in Mercer, Burlington, Camden, Gloucester, and Salem Counties, New Jersey, have been compiled for the period 1923-83. The data were collected during various U.S. Geological Survey projects, including county-wide ground-water studies, the New Jersey saltwater-intrusion monitoring network, and regional ground-water assessments. (USGS)
W86-02783

GROUND-WATER LEVELS IN OBSERVATION WELLS IN OKLAHOMA, 1982-83 CLIMATIC YEARS,
Geological Survey, Oklahoma City, OK. Water Resources Div.
R. L. Goemat, L. D. Mize, and D. E. Spiser.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-472, 1984. 583 p, 4 fig, 2 tab, 46 ref.

Descriptors: Groundwater, *Water levels, Wells, Monitoring, *Observation wells, *Groundwater levels, *Oklahoma.

In the 1982-83 climatic years, the U.S. Geological Survey, in cooperation with the Oklahoma Water Resources Board, collected ground-water level data from 1,014 sites in 77 counties. Data consist of records from continuous recorders, 3 wells measured monthly, 6 quarterly, and 1041 annually. (USGS)
W86-02784

ESTIMATING HIGHEST GROUND-WATER LEVELS FOR CONSTRUCTION AND LAND-USE PLANNING--A CAPE COD, MASSACHUSETTS, EXAMPLE,
Geological Survey, Boston, MA. Water Resources Div.
M. H. Frimpter, and M. N. Fisher.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4112, 1983. 23 p, 18 fig, 9 tab, 6 ref.

Descriptors: *Groundwater levels, Water table, *Water-level fluctuations, Observation wells, *Massachusetts, Cape Cod.

High ground water is a major cause of septic-system failures, wet basements, and other problems for suburban and rural residents. A technique for estimating the level to which groundwater can rise as a consequence of weather and seasonal factors has been developed. Water-level records from about 160 sites were used to make four maps of ranges of annual water-level change: 0-2 feet, 2-3 feet, 3-4 feet, 4-5 feet, and 5-6 feet. Nine observation wells with 16 or more years of record were used to index water-level fluctuations throughout Cape Cod. To estimate high water levels, measurements of the current depth to water at test sites are cross referenced with current depth to water in the index wells. The technique assumes good correlation between water-level fluctuations at septic-system sites and the index wells. Eighty-seven percent of the correlation coefficients determined from correlating water-level fluctuations from 146 sites with water-level fluctuations in the index wells were greater than 0.8. (USGS)
W86-02785

PRESENT AND PROPOSED GROUND-WATER LEVEL PROGRAM IN MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02788

HYDROGEOLOGIC RECONNAISSANCE OF THE SAN MIGUEL RIVER BASIN, SOUTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. J. Ackerman, and F. E. Rush.
Available from: OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4133, 1984. 25 p, 10 fig, 4 tab, 23 ref.

Descriptors: Aquifers, Confining beds, *Groundwater movement, *Groundwater contamination, Hydrologic budget, *Radioactive-waste disposal, *San Miguel River Basin, Salt anticlines, Paradox Member of the Hermosa Formation, Paradox basin, *Colorado, *Path of pollutants.

The San Miguel River Basin encompasses 4,130 square kilometers of which about two-thirds is in the southeastern part of the Paradox Basin. The Paradox Basin is a part of the Colorado Plateaus that is underlain by a thick sequence of evaporite beds of Pennsylvanian age. The rock units that underlie the area have been grouped into hydrogeologic units based on their water-transmitting ability. Evaporite beds of mostly salt are both overlain and underlain by confining beds. Aquifers are present above and below the confining-bed sequence. The principal element of ground-water outflow from the upper aquifer is flow to the San Miguel River and its tributaries; this averages about 90 million cubic meters per year. A water budget for the lower aquifer has only two equal, unestimated elements, subsurface outflow and recharge from precipitation. The aquifers are generally isolated from the evaporite beds by the bounding confining beds; as a result, most ground water has little if any contact with the evaporites. No brines have been sampled and no brine discharges have been identified in the basin. Salt water has been reported for petroleum-exploration wells, but no active salt solution has been identified. (USGS)
W86-02789

GENERALIZED CONFIGURATION OF THE BASE OF THE HIGH PLAINS AQUIFER IN KANSAS,
Geological Survey, Garden City, KS. Water Resources Div.
K. R. Watts, and L. E. Stullken.
Available from: OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 81-344, 1985. 1 p, 4 fig, 19 ref.

Descriptors: *Aquifers, *Geohydrologic units, *Geologic control, Faults, Subsidence, Hydrogeology, Maps, *Kansas, *High Plains.

The High Plains aquifer in Kansas is part of a regional system that extends from South Dakota to Texas. In Kansas, the aquifer underlies an area of 30,900 square miles in the western and south-central part. The aquifer is a hydraulically connected aggregation of unconsolidated water-bearing deposits. The High Plains aquifer is composed principally of unconsolidated alluvial deposits of Tertiary and Quaternary age. These materials were deposited on an erosion surface that had been cut into consolidated rocks of Permian, Cretaceous and Jurassic age. Dissolution of underlying Permian evaporites by ground water has been a significant factor in the faulting and subsidence of the bedrock surface in southwestern and south-central Kansas. Maps published at a scale of 1:500,000 show the altitude and configuration of the base of the aquifer. The regional gradient of the base is from west to east at about 10 feet per mile, but the gradient of the base is from west to east at about 10 feet per mile, but the local gradient may exceed 100 feet per mile in the vicinity of faults, collapsed areas, and erosional features. (USGS)
W86-02791

PRELIMINARY EVALUATION OF HYDROLOGIC PROPERTIES OF CORES OF UNSATURATED TUFF, TEST WELL USW H-1, YUCCA MOUNTAIN, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
E. P. Weeks, and W. E. Wilson.
Available from: OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4193, 1984. 30 p, 30 fig, 1 tab, 10 ref.

Descriptors: *Unsaturated flow, *Radioactive waste disposal, Permeability, Tension, Test holes, *Nevada Test Site, Yucca Mountain, *Hydrogeology, *Path of pollutants.

Analyses were made on 19 core samples of unsaturated tuff from test well USW H-1. Moisture-characteristic curves relating saturation and moisture tension were developed from results of mercury-injection tests. Ambient moisture tension estimated from these curves generally was 1 to 2 bars. Values of relative permeability ranging from about 0.002 to 0.1 were determined by fitting an analytical expression to eight of the moisture-characteristic curves, and then integrating to solve for relative permeability. These values of relative permeability were applied to values of saturated hydraulic conductivity of core from a nearby test well to obtain effective hydraulic conductivities of about 8 x 10 to the minus twelfth power to 7 x 10 to the minus tenth power centimeter per second. If a unit hydraulic-head gradient is assumed, these values convert to a vertial matrix flux of 0.003 to 0.2 millimeter per year. The validity of this assumption was not verified due to the sparseness of data and uncertainties in their reliability. Consequently, the results of this study are preliminary and need to be used principally as a guide for future studies. (USGS)
W86-02792

HYDROGEOLOGIC APPRAISAL OF A STRATIFIED-DRIFT AQUIFER NEAR SMYRNA, CHENANGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. J. Reynolds, and G. A. Brown.
Available from: OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4029, 1984. 53 p, 8 fig, 6 pl, 7 tab, 26 ref.

Descriptors: *Hydrogeology, *Groundwater data, Glacial aquifers, Aquifer management, Induced infiltration, Groundwater storage, Unconsolidated aquifers, Unconfined aquifers, Confined aquifers, Pumping tests, Glacial drift, *Groundwater storage, Separated aquifers, Valley aquifers, Stratified

drift, Aquifer evaluation, Aquifer yield, *New York, Smyrna, Chenango County.

A broad, Y-shaped valley near Smyrna, New York, contains extensive water-table and confined aquifers that are largely hydraulically separated from the nearby Chenango River to the east. Accordingly, ground-water withdrawals from this valley would not appreciably decrease streamflow in the Chenango River by induced infiltration and could be used for specialized needs. The aquifers in the valley are capable of sustaining a long-term total withdrawal of about 12.7 million gallons per day during prolonged drought conditions. Larger withdrawals could be made on a short-term basis or during periods of normal or above-normal precipitation. Saturated thickness of undifferentiated stratified-drift deposits in the valley ranges from 20 feet in the northwestern part of the valley to more than 300 feet at its southern end. Direct areal recharge accounts for about 56 percent of the total recharge to the valley aquifer infiltration from streams accounts for 24 percent, and runoff from the adjacent till-mantled hillsides accounts for 20 percent. The water-table and confined aquifers within the valley hold at least 19.6 billion gallons of usable ground water in storage. (USGS)
W86-02793

GENERALIZED POTENTIOMETRIC-SURFACE MAP OF THE HIGH PLAINS AQUIFER IN WYOMING, 1981,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02795

EVALUATION OF THE HYDROLOGIC SYSTEM IN THE DICKINSON LIGNITE AREA, EASTERN SLOPE AND WESTERN STARK AND HETTINGER COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
C. A. Armstrong.
Available from: OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4194, 1984. 35 p, 10 fig, 5 tab, 22 ref.

Descriptors: *Hydrologic system, *Groundwater, *Aquifers, Hydraulic conductivity, Recharge, Chemical properties, Potential yield, Slope County, Stark County, Hettinger County, *North Dakota.

Aquifer systems in the Dickinson lignite area of North Dakota are in sandstone beds in the Fox Hills Sandstone and lower Hell Creek Formation, in the upper Hell Creek Formation and lower Ludlow Member of the Fort Union Formation, in the upper Ludlow and lower Tongue River Members of the Fort Union Formation, and in the upper Tongue River and the Sentinel Butte Members of the Fort Union Formation. Well yields from each of the aquifer systems generally are less than 100 gallons per minute. Water in the Fox Hills-lower Hell Creek aquifer system and in the upper Hell Creek-lower Ludlow aquifer system is soft and a sodium bicarbonate type. Dissolved-solids concentrations range from 1,010 to 1,690 milligrams per liter. Water in the upper Ludlow-lower Tongue River aquifer system and in the upper Tongue River-Sentinel Butte aquifer system ranges from soft to very hard and generally is a sodium bicarbonate type. Dissolved-solids concentrations range from 574 to 2,720 milligrams per liter. Discharges of ground water are less than 0.1 cubic foot per second to the Cannonball River and less than 1.0 cubic foot per second to the Heart River. (USGS)
W86-02796

QUALITY OF GROUND WATER IN MONITOR AND WILLIAMS TOWNSHIPS, BAY COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02798

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02799

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, OREGON,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02800

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND PROVINCE, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02801

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02802

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, ARIZONA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02803

GROUND-WATER CONDITIONS IN AND NEAR THE GILA RIVER INDIAN RESERVATION, SOUTH-CENTRAL ARIZONA,
Geological Survey, Tucson, AZ. Water Resources Div.
B. W. Thomsen, and S. Baldys.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4073, 1985. 2 p, 6 fig, 1 tab, 25 ref.

Descriptors: *Groundwater pumping, *Water-level decline, Specific conductivity, *Groundwater levels, Water yield, *Arizona, *Gila River Indian Reservation, Salt River Valley.

In the early 1900's when ground-water pumping began in the vicinity of the Gila River Indian Reservation, depths to water below the land surface ranged from less than 10 feet to about 130 feet and the general direction of ground-water flow was toward the northwest. In 1983, depths to water ranged from less than 50 feet to more than 700 feet. Water level decline since 1900 was more than 550 feet near Stanfield, 500 feet near Chandler Heights, and 350 feet east of Mesa and southeast of Eloy; about 100 feet near Sacaton; and less than 50 feet near Gila Crossing. In 1983, the ground water flowed westward toward the center of cones of depression east of Mesa; near Chandler Heights, Eloy, and Arizona City; and in the Maricopa-Stanfield area. An increase in the specific conductance of ground water has accompanied the lowering of water levels in many areas.
W86-02804

MAP SHOWING OUTCROPS OF GRANITIC ROCKS AND SILICIC SHALLOW-INTRUSIVE ROCKS, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W86-02805

MAP SHOWING OUTCROPS OF ASH-FLOW TUFFS, BASIN RANGE PROVINCE AND VICINITY, TRANS-PECOS TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W86-02806

ALTITUDE AND CONFIGURATION OF THE WATER TABLE IN THE HIGH PLAINS AQUIFER IN KANSAS, PRE-1950,
Geological Survey, Garden City, KS. Water Resources Div.
L. E. Stullken, and M. E. Pabst.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 82-117, 1985. 1 p, 3 fig, 36 ref.

Descriptors: *Water table, *Potentiometric surface, Groundwater, Unconfined aquifers, Underflow, Underground storage, Water-bearing formations, Maps, *Kansas, *High Plains aquifer.

The High Plains aquifer in Kansas is a part of a regional system that extends from South Dakota to Texas. The aquifer in Kansas underlies an area of 31,000 square miles in the western and south-central part. The aquifer is a hydraulically connected assemblage of unconsolidated water-bearing deposits of Tertiary and Quaternary age. Maps at a scale of 1:500,000 show the altitude and configuration of the water table in Kansas prior to 1950. The water-table maps depict the water-level surface that was present prior to major development of the High Plains aquifer. Ground water moves from higher altitudes in the western part of the High Plains to lower altitudes in the eastern part at an average slope of 10 feet per mile. The upgradient flexure of water-table contours along some of the valleys indicates that ground water is discharged to the streams in those areas. (USGS)
W86-02807

HYDROGEOLOGIC SETTING AND THE POTENTIOMETRIC SURFACES OF REGIONAL AQUIFERS IN THE HOLLANDALE EMBAYMENT, SOUTHEASTERN MINNESOTA, 1970-80,
Geological Survey, St. Paul, MN. Water Resources Div.
G. N. Delin, and D. G. Woodward.
Available from Distribution Br. USGS, 604 S. Pickett St., Alexandria, VA 22304. USGS Water-Supply Paper 2219, 1984. 56 p, 21 fig, 1 tab, 37 ref.

Descriptors: *Areal hydrogeology, *Groundwater movement, *Potentiometric level, Aquifer characteristics, Groundwater recharge, Hollandale Embayment, *Minnesota, Cambrian-Ordovician aquifer system, Hydrogeologic units, Groundwater divides, Discharge boundary, Northern Midwest RASA study.

Sedimentary Paleozoic rocks in the Hollandale embayment in southeastern Minnesota are as much as 2,000 feet thick. This sedimentary sequence, together with the Proterozoic Hinckley Sandstone and the Quaternary drift, is divided into six regional aquifers: the undifferentiated drift, Upper Carbonate, St. Peter, Prairie du Chien-Jordan, Ironton-Galesville, and Mount Simon-Hinckley. Potentiometric-surface maps for each aquifer indicate that movement of ground water is predominantly toward the major rivers. The St. Croix, Minnesota, and Mississippi Rivers constitute regional discharge boundaries for ground-water flow. A major ground-water divide in the St. Peter, Prairie due Chien-Jordan, Ironton-Galesville, and Mount Simon-Hinckley aquifers in the south-central part of the Hollandale embayment separates groundwater flow northward toward the Twin Cities area and southward toward Iowa. The St. Peter and Prairie du Chien-Jordan aquifers in the southeastern part of the embayment contain ground-water mounds as high as 90 feet above the regional potentiometric surface. The mounds occur as a

result of recharge where the Decorah-Platteville-Glenwood confining bed has been removed by erosion and the aquifers subcrop beneath drift about 20 feet thick. This head distribution produces a locally complex pattern of flow in which ground water moves southwestward toward Iowa instead of directly toward the Mississippi River. (USGS)
W86-02809

APPRAISAL OF DATA FOR GROUND-WATER QUALITY IN NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
R. A. Engberg.
Available from Distribution Br. USGS, 604 S. Pickett St., Alexandria, VA 22304. USGS Water-Supply Paper 2245, 1984. 54 p, 29 fig, 10 tab, 20 ref.

Descriptors: *Groundwater quality, *Chemical composition, *Dissolved solids, *Calcium, *Alkalinity, *Sulfate, *Contamination, *Nebraska, Aquifer groupings, Water-quality diagrams.

Existing data on ground-water quality in Nebraska, and their adequacy as a data base, are summarized. Analyses have been made of water from nearly 10,000 wells by 8 agencies. Those analyses meeting reliability criteria have been aggregated by geologic source of water into four principal aquifer groupings--Pleistocene-Holocene aquifers, Tertiary aquifers, Mesozoic aquifers, and Paleozoic aquifers. For each aquifer grouping, data on 25 constituents or properties of water are summarized statistically. Also, diagrams are presented showing differences in statistical parameters, or in chemical composition, of water from the different aquifer groupings. Furthermore, maps show, for each grouping except Paleozoic aquifers, ranges in concentration of total dissolved solids, calcium, alkalinity, and sulfate. Areas where data are insufficient to delimit ranges in concentration are also shown on these maps. Point-source contamination has been identified at 41 locations and nonpoint-source contamination in 3 areas, namely, the Central Platte Valley, Holt County, and Boyd County. Potential for nonpoint-source contamination exists in 10 major areas, which together comprise more than one-third of the State. Existing data are mostly from specific projects having limited areas and objectives. Consequently, a lack of data exists for other areas and for certain geologic units, particularly the Mesozoic and Paleozoic aquifers. Specific data needs for each of the four principal aquifer groupings are indicated in a matrix table. (USGS)
W86-02810

GROUND-WATER LEVELS IN ARKANSAS, SPRING 1985,
Geological Survey, Little Rock, AR. Water Resources Div.
J. Edds, and J. L. Spencer.
Available from OFFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-478, 1985. 60 p, 3 fig, 16 tab, 22 ref.

Descriptors: *Groundwater levels, Aquifers, Well hydrographs, *Arkansas, Alluvial aquifer, Sparta sand, Observation wells.

The report contains 622 ground-water level measurements made in observation wells in Arkansas in the spring of 1985. In addition, the report contains well hydrographs relating to the Quaternary aquifer and the Sparta Sand aquifers, the most important aquifers with respect to ground-water availability and use in Arkansas. (USGS)
W86-02812

GROUND-WATER CONTAMINATION IN EAST BAY TOWNSHIP, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-02814

HYDROLOGIC DATA FOR AQUIFERS IN PHILADELPHIA, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02815

AQUIFEM-SALT: A FINITE ELEMENT MODEL FOR AQUIFERS CONTAINING A SEAWATER INTERFACE,
Geological Survey, Reston, VA. Water Resources Div.
C. I. Voss.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4263, 1984. 37 p, 2 fig, 9 ref, append.

Descriptors: Aquifer, *Simulation, *Saline-freshwater interfaces, *Groundwater models, *Model studies, *Finite-element analyses, Ghuben-Heerzberg lens, Freshwater lens.

Described are modifications to AQUIFEM, a finite element areal ground-water flow model for aquifer evaluation. The modified model, AQUIFEM-SALT, simulates an aquifer containing a freshwater body that freely floats on seawater. Parts of the freshwater lens may be confined above and below by less permeable units. Theory, code modifications, and model verification are discussed. A modified input data list is included. This report is intended as a companion to the original AQUIFEM documentation. (USGS)
W86-02822

HYDROLOGY OF THE TERTIARY-CRETACEOUS AQUIFER SYSTEM IN THE VICINITY OF FORT RUCKER AVIATION CENTER, ALABAMA,
Geological Survey, Montgomery, AL. Water Resources Div.
J. C. Scott, L. R. Law, and R. H. Cobb.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4118, 1984. 232 p, 14 fig, 3 tab, 25 ref.

Descriptors: *Groundwater, *Pumpage, *Coastal aquifers, *Aquifer testing, *Alabama, Potentiometric level, Water use, Municipal water, Water shortage, *Fort Rucker Aviation Center, Cones of depression, Mutual interferences, Well spacing.

Fort Rucker Aviation Center, built in 1941-42, uses ground water for its water supply. The demand for water began to exceed the capacity of the well field in 1976. The Tertiary-Cretaceous aquifer system in the Fort Rucker area consists of an upper and lower aquifer. The upper aquifer consists of the basal part of the Tuscahoma Sand, the Nanafalia and Clayton Formations, and the upper part of the Providence Sand. The lower aquifer consists of the lower part of the Providence Sand and the Ripley Formation. Most large capacity (greater than 100 gal/min (gallons per minute)) wells in the Fort Rucker area are developed in one of these aquifers, and produce 500 gal/min or more. An aquifer test made at Fort Rucker during the study indicates that the transmissivity of the upper aquifer is about 7,000 ft sq/d (feet squared per day). This test and a potentiometric map of the area indicate that wells spaced too closely together is a major problem at pumping centers in the study area. (USGS)
W86-02825

GEOHYDROLOGY OF TEST WELL USW, H-3, YUCCA MOUNTAIN, NYE COUNTY, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
W. Thordarson, F. E. Rush, and S. J. Waddell.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4272, 1985. 38 p, 20 fig, 4 tab, 32 ref.

Descriptors: *Aquifer tests, *Hydraulic conductivity, *Transmissivity, *Geophysical logging, *Nevada, Crater Flat Tuff, Lithic Ridge Tuff, Yucca Mountain, Nevada Test Site, Nye County.

Test well USW H-3 is one of several wells drilled in the southwestern part of the Nevada Test Site for hydraulic testing, hydrologic monitoring, and geophysical logging. The work was performed in cooperation with the U.S. Department of Energy. The rocks penetrated by the well to a total depth of 1,219 meters were volcanic tuffs of Tertiary age. The most transmissive zone in this well is in the upper part of the Tram Member of the Crater Flat Tuff that was penetrated at a depth from 809 to 841 meters; transmissivity is about 7 x 10 -1 meter squared per day. The remainder of the rocks penetrated between the depths of 841 to 1,219 meters have a transmissivity of about 4 x 10 -1 meter squared per day and are predominatly in the Tram Member of the Crater Flat Tuff and the Lithic Ridge Tuff in the depths from 841 to 1,219 meters. (USGS)
W86-02830

QUALITY OF WATER IN THE ALLUVIAL AQUIFER, AMERICAN BOTTOMS, EAST ST. LOUIS, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-02832

PRELIMINARY ASSESSMENT OF GROUND-WATER RESOURCES OF LAUDERDALE COUNTY, TENNESSEE,
Geological Survey, Memphis, TN. Water Resources Div.
W. S. Parks, J. K. Carmichael, and D. D. Graham.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4104, 1985. 35 p, 16 fig, 5 tab, 32 ref.

Descriptors: *Aquifer systems, *Groundwater level, *Water quality, *Aquifer characteristics, Geologic units, Subsurface mapping, Structural geology, *Tennessee, Lauderdale County.

The ground-water resource in Lauderdale County is in a rudimentary stage of development. The principal shallow aquifers are the Mississippi alluvial deposits of Quaternary age and the Cockfield Formation, Memphis Sand, and Fort Pillow Sand of Tertiary age. Water levels fluctuate seasonally. High water levels generally occur in the winter, spring, or early summer, and low water levels occur in the fall or early winter. Water from the Mississippi alluvial deposits, Cockfield Formation, and Memphis Sand is a calcium bicarbonate type and is generally of good quality. Undesirable parameters from the standpoint of use are hardness and concentrations of dissolved iron and dissolved solids. The Fort Pillow Sand, as yet untapped, has potential to yield a sodium bicarbonate type of water of somewhat better quality than is available from the shallow aquifers. Estimated values of transmissivity from single-well pumping tests are highest for the Mississippi alluvial deposits and lowest for the Cockfield. Several north-northeast and west-northwest trending faults cross the country. (USGS)
W86-02833

GENERALIZED POTENTIOMETRIC SURFACE OF AQUIFERS OF PLEISTOCENE AGE, SOUTHERN LOUISIANA, 1980,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02835

APPRAISAL OF THE WATER RESOURCES OF THE EASTERN PART OF THE TULARE AQUIFER, BEADLE, HAND, AND SPINK COUNTIES, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
L. K. Kuiper.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4078, 1984. 52 p, 33 fig, 2 ref.

Descriptors: *Computer models, *Aquifers, *Surface water-groundwater relationships, Beadle County, Hand County, Spink County, *South Dakota.

A system of glacial outwash aquifers lie in the central James Valley in east-central South Dakota. Within this system, the eastern part of the Tulare aquifer, which has an area of approximately 681 square miles, was simulated by means of a numerical ground-water flow model. The model estimates the yearly average recharge rate for that part of the aquifer lying west of the James River to be approximately 23,000 acre-feet per year. This rate is considerably more than the estimated 1978 yearly average irrigation pumpage rate of 9,800 acre-feet per year. It is expected that, since pumping will reduce discharge from the aquifer through evapotranspiration and flow to the James River, this part of the aquifer would be able to supply irrigation water at recent pumpage rates for an indefinite period. For that part of the aquifer lying east of the river, estimated recharge is 6,800 acre-feet per year; a rate slightly smaller than the estimated 1978 yearly average irrigation pumpage rate of 7,200 acre-feet per year. It is estimated that this part of the aquifer would be able to supply irrigation water at 7,200 acre-feet per year for approximately 50 years, at which time excessive drawdown would begin to cause reduced well yields at several locations. (USGS)
W86-02836

SELECTED CLIMATOLOGICAL AND HYDROLOGIC DATA, RATON BASIN, HUERFANO AND LAS ANIMAS COUNTIES, COLORADO, AND COLFAX COUNTY, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02839

GEOHYDROLOGY AND GROUND-WATER FLOW AT VERONA WELL FIELD, BATTLE CREEK, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
N. G. Grannemann, and F. R. Twenter.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4056, 1985. 54 p, 31 fig, 7 tab, 18 ref.

Descriptors: *Groundwater flow, *Hydrology, *Water supply, Municipal water, Geology, Model studies, *Michigan, *Battle Creek, Marshall Formation.

The city of Battle Creek has 30 wells in the Verona well field capable of yielding 300 to 1,000 gallons per minute each. During summer, total withdrawals are as little as 6,000 gallons per minute. In early 1984, only 9 to 12 of the wells were being used; the remaining wells were contaminated by volatile hydrocarbons. Ground-water flow is in three aquifers--a sand and gravel aquifer in deposits of Pleistocene age that overlies upper and lower sandstone aquifers of the Marshall Formation of Mississippian age. Horizontal hydraulic conductivity values are 15 to 110 feet per day for the sand and gravel aquifer, 150 feet per day for the upper sandstone aquifer, and 550 feet per day for the lower sandstone aquifer. Recharge rates range from 8 to 13 inches per year. Model simulations to evaluate the feasibility of installing new supply wells immediately north of the present field indicate that pumping 3,750 gallons per minute from new wells at the site would produce about 7 feet of drawdown. Because the new wells tap only the lower sandstone aquifer, the pumping would have little effect on the potentiometric surfaces for the two overlying aquifers. (USGS)
W86-02840

GROUND-WATER RESOURCES AND POTENTIAL HYDROLOGIC EFFECTS OF SURFACE COAL MINING IN THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02841

GROUND WATER IN UTAH'S RAPIDLY GROWING WASATCH FRONT AREA--THE CHALLENGE AND THE CHOICES,
Geological Survey, Salt Lake City, UT. Water Resources Div.
D. Price.
Available from Dist Branch, USGS 604 S. Pickett St., Alexandria, VA 22034. USGS Water-Supply Paper 2232, 1985. 71 p, 46 fig, 29 ref.

Descriptors: *Groundwater, Water levels, Water use, Water quality, Water cycle, *Utah, *Salt Lake City, Wasatch Front, Salt Lake County, Davis County, Weber County, Utah Valley.

Utah's Wasatch Front area comprises about 4,000 square miles in the north-central part of the State. In 1980 the area had a population of more than 1.1 million, or about 77 percent of Utah's population. It contains several large cities, including Salt Lake City, Ogden, and Provo. The principal source of ground water in the area is the unconsolidated fill (sedimentary deposits) in the valleys of the Wasatch Front area and the Bear River Bay area. Maximum saturated thickness of the fill in the principal ground-water reservoirs exceeds 6,000 feet, and the estimated volume of water that can be withdrawn from just the upper 100 feet of the saturated fill is about 8 million acre-feet. In most places the water is fresh, containing less than 1,000 milligrams per liter of dissolved solids; in much of the Bear River Bay area and most of Goshen Valley (and locally in the other valleys), the water is slightly to moderately saline, with 1,000 to 10,000 milligrams per liter of dissolved solids. The reservoirs receive recharge at an annual rate that is estimated to exceed 1 million acre-feet--chiefly as seepage from consolidated rocks in the adjacent mountains, canals, ditches, and irrigated land, directly from precipitation, and from streams. Discharge, which occurs chiefly from springs, as seepage to streams, by evapotranspiration, and withdrawal from wells, was estimated to be about 1.1 million acre-feet during 1980. Withdrawal from wells, which began within a few years after the arrival of the Mormon pioneers in the Salt Lake Valley in 1847, had increased to about 320,000 acre-feet during 1979. (USGS)
W86-02843

GROUND-WATER RESOURCES OF NORTHERN UTAH VALLEY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02844

GROUND WATER HYDROLOGY OF THE ELIZABETHTOWN AREA, KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
D. S. Mull, and M. A. Lyverse.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4057, 1984. 61 p, 14 fig, 8 tab, 27 ref.

Descriptors: *Groundwater, *Groundwater movement, *Karst hydrology, *Water quality, *Aquifer testing, *Carbonate aquifers, Water level fluctuations, Flow nets, Bacterial analysis, *Kentucky, Hardin County.

The principal aquifer in a 52 square mile karst area in north central Kentucky is the St. Louis Limestone of Mississippian age. Unconsolidated residuum and surficial deposits of slumped material may store water and recharge the underlying limestone aquifer. Precipitation averages 49 inches annually; 6 inches recharges ground-water reservoirs. The shallow ground-water velocity ranged from 0.30 to 1.40 feet per second. Flow net analysis indicates that about 2 million gallons of water per day flows through a 1.8 mile wide section of the aquifer. A water-level contour map indicates that the hydraulic gradient averages 40 feet per mile and that the water levels near the city supply wells have not lowered in 10 years. The effects of three faults on the ground-water flow system is shown as ponding on the upthrown side of the faults. Caliper logs suggest that shallow ground-water flow occurs in sheet-like openings within 100 feet of land surface. The openings range in height from 1 inch or less to 6 feet. A test well penetrated 5 zones of horizontal openings. The specific capacity ranged from 11.5 to 12.1 gallons per minute per foot of drawdown after 12 and 72 hours of pumping at 280 to 510 gallons per minute. Water in 28 wells and springs meets most drinking water standards and generally is a very hard calcium bicarbonate type. Heavily pumped industrial and public-supply wells tend to yield water with high values of specific conductance and sulfate. Coliform bacteria varied widely in rural wells and the city springs. Seven wells had no coliform bacteria. (USGS)
W86-02845

PALEOZOIC ARTESIAN AQUIFERS IN THE TEN SLEEP AREA OF THE BIGHORN BASIN, NORTH-CENTRAL WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. E. Cooley.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-621, 1985. 74 p, 18 fig, 9 tab, 20 ref.

Descriptors: *Confined aquifers, *Artesian pressure, Geohydrologic units, *Well yield, *Groundwater availability, Potentiometric level, Flowing wells, Water supply, Water quality, *Wyoming, Bighorn Basin, *Paleozoic aquifers, Rocky Mountain Region.

Major Paleozoic artesian aquifers in the southeastern Bighorn Basin of Wyoming area, in descending order, the Tensleep Sandstone; the Madison Limestone and Bighorn Dolomite, which together form the Madison-Bighorn aquifer; and the Flathead Sandstone. Operating yields commonly are more than 1,000 gallons per minute from flowing wells completed in the Madison-Bighorn aquifer. The initial test of one well indicated a flow of 14,000 gallons per minute. Wellhead pressures range from less than 50 to more than 400 pounds per square inch. Transmissivities are 500-1,900 feet squared per day for the Madison-Bighorn aquifer and 90-325 feet squared per day for the Tensleep and Flathead Sandstones. Despite extensive development for irrigation there have been few decreases in pressure. Some decreases in pressure have occurred in wells completed in the Flathead Sandstone. Fractures along linear structural features result in significant secondary permeability and allow upward interformational movement of water that affects the altitude of the potentiometric surfaces in the Tensleep Sandstone and Madison-Bighorn aquifer. Upward-moving water from the Tensleep and other formations discharges at the land surface as springs along or near these lineations. Water from the aquifers generally contains minimal concentrations of dissolved solids and individual constituents but has excessive hardness. The water is satisfactory for irrigation and other purposes when hardness is not a detrimental factor. Wellhead temperatures range from 11 degrees to 27.5 degrees C, giving a geothermal gradient of about 0.44 degrees C per 100 feet. (USGS)
W86-02847

REGIONAL AQUIFER-SYSTEM ANALYSIS OF THE HIGH PLAINS AQUIFER IN PARTS OF COLORADO, KANSAS, NEBRASKA, NEW MEXICO, OKLAHOMA, SOUTH DAKOTA, TEXAS, AND WYOMING--GEOHYDROLOGY,
Geological Survey, Lakewood, CO. Water Resources Div.
E. D. Gutentag, F. J. Heimes, N. C. Krothe, R. R. Luckey, and J. B. Weeks.
Available from Distribution Branch, USGS, 604 South Picket St., Alexandria, VA 22304. USGS Professional Paper 1400-B, 1984, 63 p, 27 fig, 12 tab, 178 ref.

Descriptors: *Groundwater, Geology, Hydrology, *Hydrogeology, *Aquifers, *High Plains, Colora-

do, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, Wyoming.

The High Plains aquifer underlies about 174,000 square miles in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. This aquifer is the principal source of water in one of the Nation's major agricultural areas. The High Plains aquifer mainly consists of hydraulically connected geologic units of late Tertiary or Quaternary age. The Tertiary Ogallala Formation, which underlies 134,000 square miles, is the principal geologic unit in the aquifer. Regionally, the High Plains aquifer is a water-table aquifer consisting mostly of 1,000 feet and an average of 200 feet. The aquifer contains about 3.25 billion acre-feet of drainable water. About 66 percent of the water in storage is in Nebraska and about 12 percent is in Texas. New Mexico, the State with the smallest water resource in the High Plains, has only 1.5 percent of the volume of water in storage. About 95 percent of all water pumped from the High Plains aquifer is used for irrigation. In 1978, an estimated 170,000 wells pumped 23 million acre-feet of ground water to irrigate 13 million acres. The quality of water in the aquifer generally is suitable for irrigation use, but in many places the water does not meet drinking-water standards. Excessive concentrations of dissolved solids, fluoride, chloride, and sulfate occur in parts of the aquifer in all States. The volume of water in storage in the aquifer has decreased about 166 million acre-feet since ground-water development began. About 70 percent of the depletion has occurred in Texas and about 16 percent in Kansas. (USGS)
W86-02850

USE OF A DIGITAL MODEL TO DETERMINE THE EFFECTS OF PROPOSED PUMPING FROM THE PRINCIPAL ARTESIAN AQUIFER, SAVANNAH, GEORGIA, AREA,
Geological Survey, Doraville, GA. Water Resources Div.
R. B. Randolph, and R. E. Krause.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4064, 1984. 26 p, 12 fig, 1 tab, 19 ref.

Descriptors: *Groundwater, *Computer simulation models, *Confined aquifers, *Aquifer characteristics, Carbonate rocks, Management alternatives, *Mathematical models, Model studies, Simulation analysis, Finite difference analysis, Atlantic Coastal Plain, *Georgia, South Carolina, Recharge-discharge relations, Steady-state flow.

A two-dimensional finite-difference model of the principal artesian aquifer in the Savannah, Georgia, area, originally developed by Counts and Krause (1976), has been expanded and refined. The model was updated and the grid redesigned to provide more current and accurate detail for ground-water resources management alternatives. Improvements in the definition of the flow system were made possible by the acquisition of additional data in the area and by recently completed regional models that include the area. The model was initially calibrated by using the estimated predevelopment potentiometric surface of 1880. The flow system under predevelopment conditions was sluggish and only 100 cubic feet per second (65 million gallons per day) flowed through the model area. It was then tested for acceptance by using the May 1980 potentiometric surface and corresponding pumping stress of approximately 85 million gallons per day in the Savannah, Georgia-Hilton Head Island, South Carolina, area. The flow through the system under 1980 conditions was about 390 cubic feet per second (250 million gallons per day) and the vertical inflow from the overlying surficial aquifer more than doubled due to formerly rejected recharge that now flows vertically into the aquifer. Calibration was accurate + or - 10 feet. The absolute error per node was 3.4 feet. A hypothetical 25-percent increase in pumpage over the entire area was used to represent a gradual growth in commercial and municipal pumpage over the next 20 to 30 years. The increase produced a maximum decline of 30 feet below the existing water level of 135 feet below sea level at the center of the cone of depression in Savannah, and a 5-foot decline at a radius of 20 miles from the center of the cone of depression. (USGS)
W86-02851

HYDROLOGY OF THE SOUTHERN PARTS OF OKALOOSA AND WALTON COUNTIES, NORTHWEST FLORIDA, WITH SPECIAL EMPHASIS ON UPPER LIMESTONE OF THE FLORIDAN AQUIFER,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. E. Barr, L. R. Hayes, and T. Kwader.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4305, 1985. 66 p, 29 fig, 6 tab, 22 ref.

Descriptors: *Geohydrology, Water supply, *Aquifers, *Confining bed, Water quality, *Specific capacity, Potentiometric level, Drawdown, Water level, Saline-water intrusion, Limestone, Transmissivity, *Florida, Okalossa County, Walton County, *Floridan aquifer, Fort Walton Beach, Water-level declines, Sand-and-gravel aquifer.

Increasing population in southern Okaloosa and Walton Counties have resulted in regional declines in the potentiometric surface of the upper limestone of the Floridan aquifer. Water levels have declined as much as 160 feet since 1940, and during peak seasonal demand as much as 190 feet. The Pensacola clay confining bed inhibits interchange of water between the Floridan aquifer and the surficial sand-and-gravel aquifer. The latter aquifer is of secondary importance as a public supply source. The Bucatunna clay confining bed separates the Floridan into upper and lower limestone units; the Floridan is underlain by the relatively impermeable Lisbon/Tallahatta confining unit. The Floridan aquifer dips south to the Gulf of Mexico, and is recharged by rainfall in northern Okaloosa and Walton Counties and in Alabama. The regional gradient of the potentiometric surface of the upper limestone, and presumably that of the lower limstone also, is south. Pumpage was variable in 1978; from 10.9 to 19.0 million gallons per day in January and June, respectively. Saline water in the upper limestone of the Floridan aquifer is less than 10 milligrams per liter inland but may be more than 150 milligrams per liter along the coast. Lower limestone water may exceed 250 milligrams per liter chloride. (USGS)
W86-02853

AVAILABILITY AND QUALITY OF WATER FROM THE BEDROCK AQUIFERS IN THE RAPID CITY AREA, SOUTH DAKOTA,
Geological Survey, Rapid City, SD. Water Resources Div.
K. D. Peter.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4022, 1985. 34 p, 12 fig, 3 tab, 6 ref.

Descriptors: *Groundwater, *Water quality, *Groundwater data, Hydrologic data, Data collections, Aquifers, *South Dakota, Rapid City.

An evaluation made in cooperation with the U.S. Bureau of Reclamation of the availability and quality of water from the bedrock aquifers in the Rapid City area, South Dakota, concluded that Madison aquifer has the greatest potential for additional development of the three major aquifers investigated (the Inyan Kara, the Minnelusa, and the Madison). Ground-water availability and quality were evaluated on the basis of unit thickness and depth, potentiometric-surface altitudes and gradients, estimated recharge and discharge rates, estimated aquifer transmissivities and storage coefficients, reported yields of existing wells, and concentrations of ions in the water that may affect its use as a community supply. The Inyan Kara aquifer has the least potential for additional development because of reported small well yields, the proximity of the outcrop, and concentration of radium-226 exceeding 5 picocuries per liter. The Minnelusa aquifer is unsuitable for development in the eastern two-thirds of the study area because the concentrations of dissolved solids and sulfate commonly exceed the recommended maximum level for community water supplies. The Madison aquifer has the greatest potential for additional development because it has the greatest recharge rate, has areas with significant fracture permeability, yields as much as 500 gallons per minute to wells, and has satisifactory water quality, though it is hard (hardness 120 to 180 milligrams per liter) to very hard (hardness greater than 180 milligrams per liter). (USGS)
W86-02854

PERCENTAGE CHANGE IN SATURATED THICKNESS OF THE HIGH PLAINS AQUIFER, WEST-CENTRAL KANSAS, 1950 TO AVERAGE 1982-84,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02855

OREGON GROUND-WATER QUALITY AND ITS RELATION TO HYDROGEOLOGIC FACTORS--A STATISTICAL APPROACH,
Geological Survey, Portland, OR. Water Resources Div.
T. L. Miller, and J. B. Gonthier.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4242, 1984. 88 p, 28 fig, 25 tab, 15 ref.

Descriptors: *Groundwater, Water quality, Statistical analysis, Flow system, *Hydrogeology, *Oregon, *Groundwater quality.

An appraisal of Oregon ground-water quality was made using existing data accessible through the U.S. Geological Survey computer system. The data available for about 1,000 sites were separated by aquifer units and hydrologic units. Selected statistical moments were described for 19 constituents including major ions. About 96 percent of all sites in the data base were sampled only once. The sample data were classified by aquifer unit and hydrologic unit and analysis of variance was run to determine if significant differences exist between the units within each of these two classifications for the same 19 constituents on which statistical moments were determined. Results of the analysis of variance indicated both classification variables performed about the same, but aquifer unit did provide more separation for some constituents. Samples from the Rogue River basin were classified by location within the flow system and type of flow system. The samples were then analyzed using analysis of variance on 14 constituents to determine if there were significant differences between subsets classified by flow path. Results of this analysis were not definitive, but classification as to the type of flow system did indicate potential for segregating water-quality data into distinct subsets. (USGS)
W86-02860

GENERAL DESCRIPTION OF THE GEOHYDROLOGY AND BURIAL TRENCHES AT THE LOW-LEVEL RADIOACTIVE WASTE BURIAL FACILITY NEAR BARNWELL, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02862

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN KANSAS--FISCAL YEARS 1983 AND 1984,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02865

SIMULATION OF AN AQUIFER TEST ON THE TESUQUE PUEBLO GRANT, NEW MEXICO,

Geological Survey, Lakewood, CO. Water Resources Div.
G. A. Hearne.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Supply Paper 2206, 1985. 24 p, 17 fig, 3 tab, 14 ref.

Descriptors: *Aquifer tests, *Hydrogeology, *New Mexico, Hydraulic conductivity, Storage, Water yield, Specific yield, Mathematical models, *Simulation analysis.

An aquifer test was designed and conducted in the anisotropic dipping beds of the Tesuque Formation on the Tesuque Pueblo Grant, New Mexico. The three-dimensional digital model used to analyze the test approximated the response to the test. The analysis of the geohydrology of the test site in combination with the model calibration has provided estimates of average aquifer characteristics for the group of beds penetrated at the test site; the hydraulic conductivity parallel to the beds is about 2 feet per day, the hydraulic conductivity normal to the beds is about 0.0001 foot per day or lower, the specific yield is about 0.15, and the specific storage is about 0.000001 per foot. (USGS)
W86-02866

GEOHYDROLOGY AND CHEMICAL QUALITY OF WATER IN UPPER JURASSIC AND LOWER CRETACEOUS ROCKS, WESTERN KANSAS,
Geological Survey, Lakewood, CO. Water Resources Div.
J. Kume.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4045, 1984. 54 p, 20 fig, 6 tab, 40 ref.

Descriptors: Geologic units, Sandstones, *Aquifers, Subsurface maps, *Kansas, *Water quality, *Groundwater, *Irrigation water, Upper Jurassic rocks, Lower Cretaceous rocks, Dakota aquifer, Cheyenne aquifer, Jurassic aquifer.

Fresh and saline water occur in Upper Jurassic and Lower Cretaceous rocks in western Kansas. The maximum thickness of the Jurassic aquifer is about 50 feet. During 1981, water levels ranged from 255 to 1,160 feet below land surface; the static heads ranged from about 2,400 to 3,100 feet above sea level and the hydraulic gradient ranged from 16 feet per mile toward the northeast to 40 feet per mile toward the north. The water is moderately saline, very hard, a sodium sulfate or sodium chloride type, and unsuitable for drinking and irrigation. The maximum thickness of the Cheyenne aquifer is about 190 feet. During 1981, water levels ranged from 267 to 375 feet below land surface; the static heads varied from less than 2,300 to more than 3,200 feet above sea level; and the hydraulic gradient was 8 feet per mile toward the east. The water is fresh to moderately saline, soft to very hard, a sodium sulfate or sodium, bicarbonate type, and suitable to unsuitable for drinking and irrigation. The maximum thickness of the Dakota aquifer is about 150 feet. During 1982, water levels ranged from 24 to 604 feet below land surface; the static heads ranged from about 2,100 to 3,200 feet above sea level; and the hydraulic gradient was 11 feet per mile toward the east and northeast. The water is fresh to slightly saline, soft to very hard, and suitable to unsuitable for drinking and irrigation. (USGS)
W86-02868

ANALYSIS OF THE CARMEL VALLEY ALLUVIAL GROUND-WATER BASIN, CALIFORNIA, USING DIGITAL FLOW MODEL TECHNIQUES,
Geological Survey, Sacramento, CA. Water Resources Div.
G. W. Kapple, H. T. Mitten, T. J. Durbin, and M. J. Johnson.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4280, 1984. 45 p, 14 fig, 1 pl, 6 tab, 45 ref.

Descriptors: Groundwater, Groundwater management, *Hydrologic models, Groundwater basins, *California, *Finite-element method, Computer models, Carmel Valley drainage basin, *Groundwater flow model, Digital models, Aquifers.

A two-dimensional, finite-element, digital model was developed for the Carmel Valley alluvial ground-water basin in California, using measured, computed, and estimated discharge and recharge data. Discharge data included evapotranspiration by phreatophytes, and agricultural, municipal, and domestic pumpage. Recharge data included river leakage, tributary runoff, and pumping return flow. Recharge from subsurface boundary flow and rainfall infiltration was assumed to be insignificant. From 1974 through 1978, the annual pumping rate ranged from 5,900 to 9,100 acre-feet per year, and the pumpage return flow ranged from 900 to 1,500 acre-feet per year. The aquifer properties of transmissivity (about 5,900 feet squared per day) and of the storage coefficient (0.19) were estimated from and average alluvial thickness of 75 feet and from less well-defined data on specific capacity and grain-size distribution. Calibration of the values for hydraulic conductivity and storage coefficient for the lower valley accounted for the smaller grain size there. The river characteristics were based on field and laboratory analyses of hydraulic conductivity and on survey data. The model is intended principally for simulation of flow conditions using monthly time-steps. Time variations in transmissivity and in short-term, high-recharge potential are included in the model. (USGS)
W86-02869

EFFECTS OF ARTIFICIAL RECHARGE ON THE BIG SIOUX AQUIFER IN MINNEHAHA COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02870

HYDROGEOLOGIC SETTING EAST OF LOW-LEVEL RADIOACTIVE-WASTE DISPOSAL SITE NEAR SHEFFIELD, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
J. B. Foster, G. Garklavs, and G. W. Mackey.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4183, 1984. 20 p, 13 fig, 7 ref.

Descriptors: *Geohydrologic units, *Stratigraphy, *Illinois, *Radioactive waste, *Waste disposal, Groundwater, Groundwater pollution, Water pollution sources, Strip mines, *Glacial aquifer.

Core samples from 45 test wells and 4 borings were used to describe the glacial geology of the area east of the low-level radioactive-waste disposal site near Sheffield, Bureau County, Illinois. Previous work has shown that shallow ground water beneath the disposal site flows east through a pebbly-sand unit of the Toulon Member of the Glasford Formation. The pebbly sand was found in core samples from wells in an area extending northeast from the waste-disposal site to a strip-mine lake and east along the south side of the lake. Other stratigraphic units identified in the study area are correlated with units found on the disposal site. The pebbly-sand unit of the Toulon Member grades from a pebbly sand on site into a coarse gravel with sand and pebbles towards the lake. The Hulick Till Member, a key bed, underlies the Toulon Member throughout most of the study area. A narrow channel-like depression in the Hulick Till is filled with coarse gravelly sand of the Toulon Member. The filled depression extends eastward from near the northeast corner of the waste-disposal site to the strip-mine lake. (USGS)
W86-02871

GROUND-WATER RESOURCES OF THE MATTAPOISETT RIVER AQUIFER, PLYMOUTH COUNTY, MASSACHUSETTS: SUMMARY FOR WATER-RESOURCE MANAGERS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02874

GROUND-WATER CONDITIONS AND SHALLOW TEST-WELL INFORMATION IN THE EASTERN HALF OF MERCED COUNTY, CALIFORNIA, 1977-82,
Geological Survey, Sacramento, CA. Water Resources Div.
A. L. Elliott.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4081, 1984. 56 p, 77 fig, 1 tab, 5 ref.

Descriptors: *Aquifers, *Groundwater level, Groundwater recharge, Observation wells, Potentiometric level, Test wells, Well logs, Data collections, Hydrologic data, *California, Merced.

The city of Merced, other municipalities, and irrigation in the vicinity of Merced in the San Joaquin Valley of California depend on ground water for water supply. Water-level data for 1977-81 show that there has been no significant change in water levels, indicating that during this period, recharge in the Merced area balance natural discharge and withdrawals by pumping. Lithologic logs of shallow test wells drilled around Merced indicate shallow fine-grained material in the aquifer that could interfere with surface artificial recharge to the aquifer system. Short-term and seasonal fluctuations of water levels in wells perforated at different depths and in different aquifers show dissimilar patterns in some areas. The expansion and refinement of the observation-well network will provide a data base for water-management decisions and for assessments of ground-water conditions in the future. (USGS)
W86-02876

INTERPOLATING WATER-TABLE ALTITUDES IN WEST-CENTRAL KANSAS USING KRIGING TECHNIQUES,
Geological Survey, Lawrence, KS. Water Resources Div.
L. E. Dunlap, and J. M. Spinazola.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Supply Paper 2238, 1984. 19 p, 10 fig, 18 ref.

Descriptors: *Approximation method, *Time series analysis, *Groundwater levels, *Reliability, Hydrologic data, Water distribution(Applied), Water management(Applied), Statistical methods, Kriging, *Kansas.

Kriging is a regionalization technique that incorporates autocorrelation between known data values in its estimation of values at unmeasured sites. This technique is reproducible, accepts irregularly spaced data, uses only measured values for closely surrounding points where it estimates values, is an exact interpolator at measured data points, and calculates an error of estimate. Kriging was used to interpolate water-table altitudes from 1978 and averaged 1978-80 measurements of the Ogallala aquifer in the Western Kansas Groundwater Management District No. 1. An altitude and error of estimate were provided at the center of each 1-mile section in the management district. The data were related to altitudes of the bedrock and the 1950 water table. A digital contouring procedure was used to provide maps of the water table (1978 and average 1978-80), the errors of estimate, the saturated thickness of the aquifer (1978 and average 1978-80), and the percentage changes in saturated thicknesses since 1950. Maps made by kriging compared favorably with maps contoured manually by the point-intersection technique. (USGS)
W86-02880

CHEMICAL QUALITY OF GROUND WATER IN YOLO AND SOLANO COUNTIES, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
K. D. Evenson.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4244, 1985. 50 p, 19 fig, 11 tab, 26 ref.

Descriptors: Groundwater, *Irrigation water, Water quality, Water quality standards, *Groundwater quality, Data collections, *California, Yolo County, Solano County.

Ground-water-quality conditions were investigated in Yolo and Solano Counties during the summers of 1980 and 1981 by sampling 188 representative wells. Chemical analyses of the water samples show that the ground water is suitable for domestic and most agricultural purposes. Water samples from wells near the Sacramento River generally contained lower concentrations of dissolved solids and higher concentrations of trace elements than the rest of the study area. Ninety percent of the water sampled had a dissolved-solids concentration of less than 850 milligrams per liter. Chemical water types varied, with 72 percent of the wells sampled containing either sodium bicarbonate, magnesium bicarbonate, sodium-magnesium bicarbonate, or magnesium-sodium bicarbonate type water. A large part of the study area contains ground water with boron concentrations that exceed tolerance levels for many crops. Other toxic trace elements were present in negligible amounts. (USGS)
W86-02884

EXAMPLE CALCULATIONS OF POSSIBLE GROUND-WATER INFLOW TO MINE PITS AT THE WEST DECKER, EAST DECKER, AND PROPOSED NORTH DECKER MINES, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02886

SUMMARY OF WATER RESOURCES DEVELOPMENT AND HYDROLOGIC DATA OF SAIPAN, MARIANA ISLANDS,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02887

GEOHYDROLOGY AND GROUND-WATER QUALITY MONITORING NETWORK FOR THE LOWER MOJAVE RIVER VALLEY, CALIFORNIA,
Geological Survey, Santee, CA. Water Resources Div.
L. R. Woolfenden.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4148, 1984. 58 p, 8 fig, 10 tab, 23 ref.

Descriptors: Hydrology, Surface water, *Geohydrology, Groundwater, Groundwater quality, Land use, *Groundwater quality monitoring network, Lower Mojave River Valley, Coyote Lake Valley, Caves Canyon Valley, Barstow, San Bernardino County, *California.

A ground-water-quality monitoring network was developed for the Lower Mojave River valley to define the ground-water quality of the valley. Basin geohydrology, geology, land use and water-level and water-quality data were factors considered in developing objectives for an ideal network. These objectives were used in selecting well locations for the conceptual ground-water-quality monitoring network. The conceptual network was used as a guide in the design of the ground-water-quality monitoring network. Active monitoring sites are wells that are currently being monitored by some agency and were selected whenever possible because of budgetary constraints. In areas where no wells are currently being monitored, new well locations were selected and are considered proposed monitoring sites. A sampling regimen is also included. (USGS)
W86-02888

GEOHYDROLOGIC AND DRILL-HOLE DATA FOR TEST WELL USW H-4, YUCCA MOUNTAIN, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
M. S. Whitfield, W. Thordarson, and E. P. Eshom.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-449, 1984. 39 p, 26 fig, 9 tab, 7 ref.

Descriptors: *Aquifer tests, *Transmissivity, *Hydraulic conductivity, *Radioactive-tracer flow survey, *Geophysical logging, Chemical analysis, *Nevada, *Groundwater movement, Nye County, Nevada Test Site, Yucca Mountain.

Data are presented on drilling operations, lithology, geophysical well logs, sidewall-core samples, water-level monitoring, pumping tests, injection tests, radioactive-tracer borehole flow survey, and water chemistry for test well USW H-4. The well is one of a series of test wells drilled in the southwestern part of the Nevada Test Site, Nye County, Nevada, in cooperation with the U.S. Department of Energy. These test wells are part of the Nevada Nuclear Waste Storage Investigations to identify sites for storage of high-level radioactive wastes. Test well USW H-4 was drilled in ash-flow tuff to a total depth of 1,219 meters. Depth to water below land surface was 519 meters or at an altitude of 730 meters above sea level. After test pumping at a rate of 17.4 liters per second for approximately 9 days, the drawdown was 4.85 meters. A radioactive borehole-flow survey indicated that the Bullfrog Member was the most productive geologic unit, producing 36.5 percent of the water in the well. The second most productive geologic unit was the Tram Member, which produced 32 percent of the water. The water in test well USW H-4 is predominantly a soft, sodium bicarbonate type of water typical of water produced in tuffaceous rocks in southern Nevada. (USGS)
W86-02895

RESULTS OF GEOHYDROLOGIC TEST DRILLING IN THE EASTERN SNAKE RIVER PLAIN, GOODING COUNTY, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
R. L. Whitehead, and G. F. Lindholm.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4294, 1985. 30 p, 7 fig, 4 tab, 17 ref.

Descriptors: Test holes, *Piezometers, *Water table fluctuations, *Core drilling, Confining beds, Basalts, *Borehole geophysics, Drillers' logs, Geologic control, Hydrogeology, Snake River Plain, *Idaho, Gooding County.

A 1,123-foot test hole was core drilled near Wendell, Idaho, during 1981-82 as part of the Snake River Plain regional aquifer study. An upper basalt unit, an intermediate unconsolidated sedimentary rock unit, and a lower basalt unit were penetrated by the test hole. Drilling verified that the upper several hundred feet of high-resistivity material, as determined by surface electrical soundings, is basalt. Core examination, laboratory analysis, and correlation with other drill holes indicated that the basalt is typical of Quaternary basalt of the Snake River Group. Quaternary basalt in the test hole is 200 feet thick. Correlation with other drill holes and comparison with rock outcrops near the Snake River and in the Snake River canyon suggest that the underlying sediments and lower basalt unit are parts of the Tertiary and Quaternary Glenns Ferry Formation and Tertiary Banbury Basalt. Piezometers in the hole verify upward movement of water in a major discharge area for the regional aquifer. Hydraulic head in the bottom of the hole is about 155 feet higher than the water table. Lithologic sequence in the test hole correlates well with sequences in deep drill holes at scattered locations on the plain. (USGS)
W86-02896

GEOHYDROLOGY OF THE CENTRAL MESILLA VALLEY, DONA ANA COUNTY, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
C. A. Wilson, and R. R. White.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 82-555, 1984. 144 p, 16 fig, 5 tab, 11 ref.

Descriptors: Deep wells, Irrigation wells, Observation wells, *Groundwater, Aquifers, *Aquifer characteristics, Water quality, Transmissivity, Drawdown, Hydraulic conductivity, Drains, *New Mexico, Mesilla Valley, Elephant Butte Irrigation District, Rio Grande.

Five large-capacity irrigation wells, with depths ranging from 370 to 686 feet, were drilled by the Elephant Butte Irrigation District between 1973 and 1975, in the Mesilla Valley about 7 miles south of Las Cruces, New Mexico. These were the first deep wells in the area, and their installation provided an opportunity to conduct extensive aquifer tests under relatively undisturbed conditions. The deep irrigation wells are perforated in the Santa Fe Group of Miocene to Pleistocene Age. The Santa Fe Group is composed of interfingering and alternating beds of clay, silt, sand, and small gravel. In the area of these wells, the upper part of the saturated zone contains slightly saline water to a depth of about 100 to 175 feet below the water table, underlain by a freshwater zone extending to depths greater than 1,200 feet. As water is pumped from the freshwater zone, leakage occurs from above and below the perforated interval. At one of the irrigation district wells, slightly saline water moved downward because of a lack of confining layers in the aquifer. At three other wells, the surface casing was not set deep enough and slightly saline water moved into the top of the perforations, downward in the casing, and into the freshwater part of the aquifer. (USGS)
W86-02898

AQUIFER TESTS IN WEST-CENTRAL FLORIDA, 1952-76,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. M. Wolansky, and M. A. Corral.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4044, 1985. 127 p, 11 fig, 3 tab, 35 ref.

Descriptors: *Aquifer characteristics, Aquifers, Transmissivity, Storage coefficient, Leakage, Groundwater, *Florida, *Hydrogeology, *Floridan aquifer, Intermediate aquifer, Surficial aquifer, Confining beds, Leakance.

The ground-water system in west-central Florida is composed of, in descending order, the surficial (usually unconfined) aquifer, intermediate aquifer and confining beds, Floridan aquifer, and lower confining bed. Aquifer test data were analyzed to determine transmissivity, storage coefficient, leakance, and vertical hydraulic conductivity of the aquifers and confining beds. Transmissivities obtained from 29 aquifer tests range from 1,900 to 920,000 feet squared per day for parts of the Floridan aquifer, about 740 to 7,800 feet squared per day for the intermediate aquifer, and about 220 to 600 feet squared per day for the surficial aquifer. Storage coefficients obtained from aquifer tests range from 0.00013 to 0.0015 for the Floridan aquifer, 0.00005 to 0.00017 for the intermediate aquifer, and 0.004 to 0.02 for the surficial aquifer. The values of leakance obtained from aquifer tests range from 0.00005 to 0.009 feet per day per foot for the Floridan and 0.0002 to 0.0007 feet per day per foot for the intermediate aquifer. (USGS)
W86-02899

EFFECTS OF FRACTURING ON WELL YIELDS IN THE COALFIELD AREAS OF WISE AND DICKENSEN COUNTIES, SOUTHWESTERN VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
W. G. Wright.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4061, 1985. 21 p, 7 fig, 4 tab, 11 ref.

Descriptors: *Groundwater, *Fracture permeability, *Aquifer testing, Coal mining, *Virginia, *Hydrogeology, *Injection testing, Lineaments.

Fracturing associated with lineaments are the primary influence on yields from wells in the coalfields of southwestern Virgnia. Graphical comparison of yield from wells shows that wells located in valleys with lineaments produce larger quantities of water than wells in valleys without lineaments. Pumping tests at wells located in valleys with lineaments indicate transmissivities as high as 598 ft2/d, caused principally by secondary permeability. Analysis of data collected from packer-injection tests in a test hole located on a ridge indicate relatively large hydraulic conductivities ranging from 2x10(sup -2) to 1x10(sup -1) feet per day in upper parts of the test hole, compared to values typical of unfractured rocks in the study area. Fracturing due to stress relief contribute to these large values. Yields from wells located on lineaments are consistently higher than well yields from wells in unfractured rock in the study area, but well yields from wells placed randomly in areas suspected of having stress relief fractures cannot be predicted. (USGS)
W86-02900

GROUND WATER IN THE DICKSON AREA OF THE WESTERN HIGHLAND RIM OF TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
M. W. Bradley.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 82-4088, 1984. 42 p, 27 fig, 10 tab, 18 ref.

Descriptors: *Groundwater, *Geohydrology, Groundwater availability, Carbonate rocks, Well data, Groundwater data, Western Highland Rim, *Tennessee, Mississippian formations.

A hydrologic study of the Dickson, Tennessee, area provided additional information on the occurrence of ground water in the Mississippian carbonate rocks of the western Highland Rim. Twenty-six test wells were drilled to determine the occurrence of ground water in relation to topographic position, regolith thickness, streamflow gains or losses, and the lithology of the underlying formations. Yields to 26 test wells ranged from 0 to about 300 gal/min and averaged about 68 gal/mi. Nine wells yielded 80 to about 300 gal/min; their specific capacities ranged from about 0.71 to 12.7 (gal/min)/ft of drawdown. Seven of these nine wells yielded water from solution openings in the Warsaw Limestone. The other two wells yielded water from gravel and sand in the regolith. Yield-specific-capacity tests were made on two wells. One well was pumped at an average rate of 350 gal/min for 72 hours with 39.77 feet of drawdown. The second well was pumped for 8 hours at 120 gal/min with 20.86 feet of drawdown. The water from both wells was generally of good quality. Dissolved solids concentrations were less than 200 mg/L. (USGS)
W86-02901

RECONNAISSANCE OF GROUND-WATER RESOURCES IN THE LOWER GUNNISON RIVER BASIN, SOUTHWESTERN COLORADO,
Geological Survey, Grand Junction, CO. Water Resources Div.
T. Brooks, and D. J. Ackerman.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4185, 1985. 30 p, 5 fig, 6 tab, 17 ref.

Descriptors: Aquifers, *Groundwater availabilty, *Water quality, *Alluvial aquifers, Geohydrology, Springs, Wells, Mancos Shale, Mesaverde Formation, Dakota Sandstone, Lower Gunnison River basin, Montrose County, Delta County, Mesa County, *Colorado.

Information about ground-water quantity and quality in the lower Gunnison River basin assists in developing, appropriating, and managing the basin's water resources. Hydrogeologic data are presented for 51 wells and 61 springs. Chemical analyses are given for 34 wells and 17 springs. Drillers' reports for 71 wells are included. Springs normally discharge from short alluvial flow systems and commonly are less saline than well water. These springs are a calcium magnesium bicarbonate water type. Spring discharges of as much as 200 gallons per minute were measured. The most productive wells in the study area are completed in alluvium, with reported yields of as much as 750 gallons per minute for an irrigation well. Alluvial gravels are most productive. Specific-conductance values of water samples from alluvial deposits ranged from 80 to 32,200 micromhos per centimeter at 25 Celsius. The Mancos Shale and Mesaverde Formation include aquifers with large areal extents. Reported yields of wells completed in the Mesaverde Formation range from 0.7 to 24 gallons per minute. The Dakota Sandstone, Morrison Formation, and Entrada Sandstone include potential aquifers of lesser extent. Reported yields of wells completed in the Dakota Sandstone range 5 to 14 gallons per minute in the study area. Specific-conductance values of water samples from the Mesaverde Formation ranged from 325 to 5,390 micromhos per centimeter at 25 Celsius. Insufficient data prevented water-quality analysis of other rock units. (USGS)
W86-02902

COMPILATION OF SELECTED HYDROLOGIC DATA FROM THE MX MISSILE-SITING INVESTIGATION, EAST-CENTRAL NEVADA AND WESTERN UTAH,
Geological Survey, Carson City, NV. Water Resources Div.
R. L. Bunch, and J. R. Harrill.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-702, 1984. 123 p, 2 fig, 48 ref.

Descriptors: *Springs, *Water level, *Water quality, Discharge measurement, *Great Basin, *Nevada, *Utah, Hydrologic data.

Construction, water-level, and water-quality data for wells and site-description, discharge, and water-quality data for springs and streams in 37 hydrographic areas in Nevada and Utah are presented in the report. These data are grouped in tables, by area. Additional tables contain a summary of data and aquifer-test results for wells in valley-fill deposits at 42 sites in Nevada and Utah and for wells in carbonate rocks at five sites in Nevada. The data in the report were gathered by Ertec Western, Inc., or their subcontractors, for the U.S. Department of the Air Force as part of the MX missile-siting project and were originally presented in a number of individual reports. (USGS)
W86-02903

HYDROLOGIC SETTING OF MIRROR LAKE, WEST THORNTON, NEW HAMPSHIRE,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2H.
W86-02905

DESIGN OF A GROUND-WATER QUALITY MONITORING NETWORK FOR THE SALINAS RIVER DRAINAGE BASIN, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02909

GROUND-WATER WITHDRAWALS FROM THE COASTAL PLAIN OF NEW JERSEY, 1956-1980,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02911

HYDROLOGY OF AREA 56, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, UTAH AND COLORADO,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02913

REGIONAL AQUIFER-SYSTEM ANALYSIS OF THE NORTHERN GREAT PLAINS IN PARTS OF MONTANA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING--FRESHWATER HEADS AND GROUND-WATER TEMPERATURES IN AQUIFERS,
Geological Survey, Lakewood, CO. Water Resources Div.
D. H. Lobmeyer.
Available from Dist Branch, USGS 604 S. Pickett St Alexandria, VA 22304. USGS Professional Paper 1402-D, 1985. 11 p, 7 fig, 27 ref.

Descriptors: Water temperatures, *Groundwater, Aereal hydrology, Potentiometric levels, *Great Plains, Montana, North Dakota, South Dakota, Wyoming, *Regional analysis, Geohydrologic units, Powder River basin, Williston basin, Tertiary aquifer, Upper Cretaceous aquifer, Lower Cretaceous aquifer.

Potentiometric surfaces of the Tertiary aquifer, the Upper Cretaceous aquifer, and the Lower Cretaceous aquifer in the Northern Great Plains of Montana, North Dakota, South Dakota, and Wyoming generally follow land-surface gradients except in areas where geologic structure or lithologic change cause large differences in transmissivity, flowpath, or both. Ground-water temperatures generally are controlled by the burial depth of the aquifer. Actual-equilibrium water temperatures are estimated to range from about 7 to about 174C. No areally extensive temperature anomalies were detected. Water temperatures in the Upper Cretaceous and Lower Cretaceous aquifers were mapped. Potentiometric surfaces referred to pure water at 4C are mapped for the Tertiary aquifer, the Upper Cretaceous aquifer, and the Lower Cretaceous (Dakota) aquifer in the Northern Great Plains. Water temperatures also were mapped for the Upper Cretaceous aquifer and the Lower Cretaceous aquifer. (USGS)
W86-02914

RECONNAISSANCE EVALUATION OF CONTAMINATION OF THE ALLUVIAL AQUIFER IN THE EAST POPLAR OIL FIELD, ROOSEVELT COUNTY, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02915

GROUND-WATER WITHDRAWALS AND CHANGES IN THE WATER LEVELS IN THE HOUSTON DISTRICT, TEXAS, 1975-79,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02918

ALTITUDE AND CONFIGURATION OF THE WATER TABLE IN THE HIGH PLAINS AQUIFER IN KANSAS, 1980,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02919

2G. Water In Soils

UTILIZATION OF THERMAL EMITTANCE DATA TO MONITOR SOIL MOISTURE AND SUBSURFACE GROUNDWATER,
South Dakota State Univ., Brookings. Dept. of Physics.
For primary bibliographic entry see Field 2F.
W86-02429

RELATIONSHIP BETWEEN SOIL MOISTURE STORAGE AND DEEP PERCOLATION AND SUBSURFACE RETURN FLOW,
Texas Water Resources Inst., College Station.
J. L. Nieber.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211688/AS, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, 1984. 88 p, 3 tab, 43 fig, append 19 ref. B-248-TEX(1). 14-34-0001-1269.

Descriptors: *Return flow, *Percolation, *Soil moisture, Simulation study, Finite element analysis, Richards equation, *Texas.

A simulation study was performed to analyze the relationship between the volume of moisture stored in a soil profile and the rate of percolation and subsurface return flow. The simulation study was derived on the basis of the Richards equation. The one-dimensional form of the Richards equation was used for the subsurface return flow process. In each case the Richards equation was transformed to a set of nonlinear algebraic equations using the finite element method to transform the space derivatives and the finite difference method to transform the time derivatives. The system of nonlinear algebraic equations were solved using the Gaussian elimination procedure and an under-relation procedure. To characterize the percolation and subsurface return flow processes a sensitivity analysis was performed by varying parameters of the soil systems. It was found that the relationships between stored soil moisture and deep percolation and between stored soil moisture and subsurface return flow each form hysteresis loops. The percolation loops were most sensitive to soil texture class, and water application rate and relatively insensitive to soil layering, evapotranspiration, and water table depth. The subsurface return flow loops were sensitive to soil texture, soil slope angle, length of the soil slope relative to soil depth, and water application rate and relatively insensitive to soil layering. The resulting percolation and subsurface return flow characteristics suggest the possibility of utilizing the derived characteristics in the physical representation of these processes in comprehensive hydrologic models.
W86-02439

ACID PRECIPITATION: COMPOSITIONAL CHANGES DURING THROUGHFALL; SOIL WATER,
Vermont Univ., Burlington. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W86-02457

ADAPTING THE WATER MANAGEMENT SIMULATION MODEL DRAINMOD FOR THE GREAT LAKES REGION,
Michigan State Univ., East Lansing. Dept. of Agricultural Engineering.
G. E. Merva, T. L. Loudon, and P. N. Brink.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214807/AS, Price codes: A07 in paper copy, A01 in microfiche. Technical Completion Report, Michigan Institute of Water Research, East Lansing, September, 1984. 55 p, 10 fig, 2 tab, 30 ref. USGS G849-06.

Descriptors: *Mathematical models, *Soil water movement, *Computer programs, Water management, Model, Simulation, Drainage, Subirrigation, Michigan.

A soil water simulation management model, DRAINMOD, developed at North Carolina State University was tested and adapted for use in the North Central Region of the United States, particularly Michigan. DRAINMOD is capable of characterizing the response of the soil water regime to various combinations of surface and subsurface water management. The program was converted from mainframe FORTRAN into BASIC for use on a micro-computer to improve ease in use and increase its availability to contractors, consultants, and agency people. Appropriate modifications to the model, made in close coordination with agricultural engineers in the North Central Region were made to the model so that it could be utilized for design and analysis of drainage and subirrigation systems applicable in the North Central region. Data from a field in Tuscola county, Michigan, was obtained and a 15 year simulation was run to assess the performance of the model, to demonstrate its use, and to compare the predicted results obtained with farmer's subirrigation practices. Use of the model can improve understanding and provide for more rational design of subsurface drainage and subirrigation systems.
W86-02483

FACTORS INFLUENCING, INFILTRATION, FLOW, INSTABILITY, AND MOVEMENT OF TOXICS IN LAYERED FIELD SOILS,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W86-02527

LATERAL MOISTURE MOVEMENTS IN UNSATURATED ANISOTROPIC MEDIA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
A. Giorgini, M. Bergman, J. Pravia, and A. Hamidi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225860/AS, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No. 169, September, 1984. 105 p, 25 fig, 1 tab, 108 ref, append. USGS G841-03.

Descriptors: *Infiltration, Percolation, Storm Seepage, *Path of pollutants, *Soil water movement, *Unsaturated flow, *Indiana, Finite difference analysis.

Traditionally, in the area of water resources, interests are focused on contamination of groundwater basins and surface water basins, and the subsequent distribution of those contaminants in our environment. In the study presented in this report, it is emphasized that the contamination processes involve, additionally, the vadose zone below the soil surface. In this respect, the classical approach, which assumes only vertical infiltration, is abandoned and a more comprehensive theory which includes inclination of the soil surface and anisotropic hydraulic conductivity, is developed. For these more general conditions, an infiltration model is presented, which is in form and structure similar to the equation of solely vertical infiltration. It is shown that, under particular conditions which are chosen so as to emphasize the importance of the problem, lateral infiltration occurs and that it may be more dominant than vertical infiltration. Because the proposed infiltration model is similar in form and structure to the vertical infiltration model, a numerical solution of the latter is presented by means of an explicit finite difference scheme. The boundary conditions constraining the solution are relaxed with respect to soil moisture content at the surface for the beginning of the infiltration process. This condition supports the philosophy underlying this study, namely the formulation of a general infiltration model as opposed to a simple vertical infiltration model.
W86-02562

CHARACTERIZING WATER MOVEMENT IN THE WEATHERED ZONE OF GLACIAL TILLS UNDER CONTINUOUS IRRIGATION,
South Dakota State Univ., Brookings. Water Resources Research Inst.
For primary bibliographic entry see Field 2F.
W86-02626

EVALUATION OF 0.1 N NAHCO3 EXTRACTION FOR DETERMINATION OF AVAILABLE NITROGEN,
Delaware Univ., Newark. Dept. of Plant Science.
L. J. Cotnoir, and M. R. Teel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101227/AS, Price codes: A03 in paper copy, A01 in microfiche. Delaware Water Resources Center, Technical Completion Report, Newark, July 1983. 42 p, 2 fig, 18 tab, 57 ref. A-049-DEL(1).

Descriptors: *Agricultural runoff, *Groundwater pollution, *Soil chemistry, *Fertilizers, Crop yield, Nitrogen, Nitrates, Organic matter, Agricultural chemicals, Crop production, Nitrogen compounds.

Soil samples from research plots exhibiting variations in residual soil N were used to determine whether extraction with 0.01 NaHCO3 could be used as a reliable and rapid method for measuring available soil N. In order to determine the variation in N released, samples were incubated for a two month period and NO3 production was measured. UV absorptive values of NaHCO3 extracts were weakly correlated with NO3 production after varying periods of incubation. Values from the incubation determinations and NaHCO3 extractions were regressed against organic matter, leaf N content of corn and corn yields. NaHCO3 extracts were positively and significantly correlated to leaf N, positively but not significantly correlated to soil organic matter, and not correlated to corn yields. Soil organic matter was positively and significantly correlated to corn yields. NO3 production on incubation was positively and significantly correlated to soil organic matter for the final two weeks of incubation but not for the earlier periods of incubation. There was a positive but not significant correlation between the amount of NO3 produced on incubation and leaf N and corn yield. The highest degree of correlation was between corn leaf N and corn yield. The N content of corn leaves at the time of tasseling was the best predictor of corn yields. Neither the amount of NO3 produced by incubation nor the amount of organic matter extracted with NaHCO3 were reliable indicators of soil N availability or predictors of corn yields. (Author)
W86-02703

2H. Lakes

EVALUATION OF NITROGEN AND PHOSPHORUS ENRICHMENT USING IN SITU ENCLOSURE BAGS WITH TEMPORAL INDIGENOUS PHYTOPLANKTON POPULATIONS,
Arkansas Univ., Fayetteville. Dept. of Botany and Microbiology.
R. L. Meyer, and W. R. Green.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211787/AS, Price codes: A03 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project Completion Report, Pub. No. 110, Sept. 1984. 33 p, 7 tab. USGS G-829-04.

Descriptors: *Nitrogen, *Phosphorus, *Arkansas, Enclosures, Lakes, Phytoplankton, Algae, Standing crop, Limiting factors, Eutrophication, Bioassay.

An in situ experimental procedure and protocol was developed to evaluate nitrate and phosphate enrichment using isolated indigenous phytoplankton assemblages during different seasons. Results of the comparison of the parameters-temperature, pH, alkalinity, conductivity, and dissolved oxygen between the open water and enclosed systems indicated that there was no significant influence of the physicochemical factors on the isolated biological processes. Growth responses were measured by turbidity, biomass and chlorophyll-a, the most sensitive being chlorophyll-a. Additions of nitrate and phosphate were added in known concentrations and in different magnitudes of concentration based upon ambient conditions and ratio. During the fall, phosphorus influenced phytoplankton growth, whereas in the spring, both nutrients effect growth response equally, and in the summer nitrate had the greatest influence. Based upon the results of these experiments a sampling regime for physicochemical parameters and growth response is recommended.
W86-02449

HYDRILLA MANAGEMENT IN NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of

Zoology.
R. G. Hodson, G. J. Davis, and K. E. Langeland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215044/AS, Price codes: A04 in paper copy, A01 in microfiche. Project Completion Report No. 217, North Carolina Water Resources Research Institute, Raleigh, August 1984. 63 p, 8 fig, 9 tab, 28 ref. USGS G860-03.

Descriptors: *Aquatic weed control, *Aquatic weeds, *Herbicides, *Water management, *Hydrilla, Water level fluctuations, Weed control, Carp, Tilapia, Grass carp. *North Carolina.

Studies of the phenology and management of hydrilla were conducted in lakes and ponds in Wake County, North Carolina during July 1982-July 1984. Growth of hydrilla began in late March to early April when water temperature was 11-13C. Standing crop biomass peaked in September at 180 to 375 g m-2 dry weight. No plant beds overwinter in North Carolina. Hydrilla reproduces asexually by tubers, turions, plant fragments and stolons. Tubers, which form in the hydrosoil, are the primary means for hydrilla to overwinter in North Carolina. Grass carp (Ctenopharyngodon idella) controlled hydrilla when stocked at 50 or more per hectare. Areas stocked with grass carp in spring 1983 had no measurable biomass in September 1983 or June 1984. Redbelly tilapia (Tilapia zilli) stocked at 700 and 2800/ha reduced attached biomass by 50% but produced a substantial amount of floating fragments. Herbicide control of hydrilla was variable among different herbicide treatments, location of treatments and time of application. Diquat + copper and copper alone gave partial and temporary control in some plots in June. Very good control was observed in Reedy Creek Lake but not in Lake Anne after June treatments with endothal. None of the August or September treatments were successful. Poor control with herbicides was thought to be due to one or more of several factors such as absorption by suspended clay and organic particulates, depth and dilution. Drawdown treatments were completely ineffective in controlling hydrilla.
W86-02507

ANALYSIS OF THE WATER BALANCE OF B. EVERETT JORDAN LAKE INCLUDING ESTIMATES OF FLOWS BETWEEN SEGMENTS,
North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 4A.
W86-02686

ASSESSING HABITAT SUITABILITY FOR WALLEYE (STIZOSTEDIAN VITREUM) AND POSSIBLE SPECIES INTERACTIONS WITH SALMONID FISHES,
Idaho Univ., Moscow. Dept. of Fish and Wildlife.
D. H. Bennett, and T. J. McArthur.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249092/AS, Price codes: A04 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, Moscow Completion Report, January, 1985, 62 p, 3 fig, 5 tab, 43 ref. USGS G839-07. 14-08-0001-G839.

Descriptors: *Idaho, *Computer models, Exotic fishes, *Fish habitat, Mathematical models.

Exotic fishes and their interactions with resident fish communities have been a concern of fisheries managers for years. Focusing on walleye (Stizostedion vitreum) as an exotic fish, discriminant and loop analyses were used to assess habitat suitability and possible interactions with salmonid fishes. Results corroborate previous field observations and published literature.
W86-02688

TROPHIC STATE INDEX FOR THE LOUISIANA COASTAL ZONE,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
A. S. Witzig, and J. W. Day.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101292/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Report to the Louisiana Water Resources Research Institute, Baton Rouge, April 1983. 35 p, 4 fig, 9 tab, 32 ref. A-047-LA(2).

Descriptors: *Louisiana, *Trophic level, Multivariate analysis, *Chemical properties, *Eutrophication, Nitrogen, Phosphorus, Chlorophyll, Statistical methods, Water quality, Turbidity, Statistical models, Mathematical studies, Estuaries.

A multivariate trophic state index (TSI) was developed from an investigation of water chemistry in the Barataria basin Louisiana, based on a principal component analysis of 4 variables (total organic N, total P, secchi depth and chlorophyll a) for 23 sampling stations in the Barataria basin. A cluster analysis of the same 4 variables and stations defined 3 groups of stations with similar trophic characteristics. By comparison with other trophic classifications, these groups represent mesotrophic to very eutrophic water quality. The TSI was tested with several sets of independently collected data: water chemistry data collected in the middle portion of the Barataria basin; data from Lake Pontchartrain, Louisiana, and surrounding wetlands; and primary productivity measurements in the Barataria basin. Carlson's (1977) trophic state indices for secchi depth, chlorophyll a and total P were also calculated from the original set of data for comparison with the multivariate TSI. The results of the first 3 comparisons were very satisfactory in that they illustrated the practical application of the TSI as well as natural variation in trophic state due to changing environmental conditions. Although Carlson's indices were highly correlated with the multivariate TSI, the discrepancy between the chlorophyll a index and the others indicate that this more simple method is not appropriate for the highly turbid waters of the Barataria basin. (Author)
W86-02710

FATE OF PHOSPHORUS IN SECONDARILY TREATED WASTEWATER APPLIED TO A FRESHWATER MARSH,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5E.
W86-02720

RELATIONSHIP BETWEEN CHEMICALLY DETERMINED AND BIOLOGICALLY AVAILABLE FORMS OF PHOSPHORUS IN LAKES AND STREAMS,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
For primary bibliographic entry see Field 5B.
W86-02721

INTEGRATED LAKE-WATERSHED ACIDIFICATION STUDY, VOLUME 2--HYDROLOGIC ANALYSIS,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02777

CHEMICAL AND BIOLOGICAL QUALITY OF SELECTED LAKES IN OHIO, 1978 AND 1979,
Geological Survey, Columbus, OH. Water Resources Div.
C. G. Angelo, and J. D. Youger.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-249, 1985. 294 p, 65 fig, 147 tab, 54 ref.

Descriptors: *Lakes, *Reservoirs, *Water quality, Hydrologic data collections, Chemical properties, Physical properties, Algae, Bacteria, Limnology, *Ohio.

Twenty-eight Ohio lakes were sampled by the U.S. Geological Survey and the Ohio Environmental Protection Agency for water-quality characteristics during 1978 and 1979. Chemical, physical, and biological data were collected at specific points in the water column. Selected physical and chemical data were also collected in the principal inflows. The lakes were predominately hard to very hard water, although several soft-water lakes were found in southeastern Ohio. Calcium, bicarbonate, and sulfate were the principal constituents. Specific conductance ranged from 103 to 2,250 micromhos per centimeter. Thirteen lakes had trace-element concentrations above the limits for exceptional warmwater habitat recommended by the Ohio Environmental Protection Agency. Seasonal thermal gradients developed in most lakes deeper than 17 feet. Anaerobic or nearly anaerobic conditions were observed during the summer sampling of the bottom waters of all lakes having suitable thermal gradients. Many anaerobic zones contained hydrogen sulfide and high concentrations of ammonia. All lakes were evaluated and classified by Carlson's trophic state index. Most lakes were classified as eutrohic. Fecal coliform counts were within Ohio standards, although high feca coliform and fecal streptococcus counts were observed after significant runoff. (USG)
W86-02786

WATER-QUALITY CHARACTERISTICS OF ABHA RESERVOIR, ABHA, SAUDI ARABIA,
Geological Survey, Atlanta, GA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02820

GAZETTEER OF SURFACE-MINE LAKES, EASTERN INTERIOR COAL PROVINCE, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-02831

PHOSPHORUS LOADING TO MCGRATH AND ELLIS PONDS, KENNEBECK COUNTY, MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02859

ESTIMATED WATER AND NUTRIENT INFLOWS AND OUTFLOWS, LAKE COCHITUATE, EASTERN MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02904

HYDROLOGIC SETTING OF MIRROR LAKE, WEST THORNTON, NEW HAMPSHIRE,
Geological Survey, Lakewood, CO. Water Resources Div.
T. C. Winter.
Available from OFSS, USGS Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4266, 1984. 61 p, 33 fig, 5 tab, 27 ref.

Descriptors: *Limnology, Water budget, *Groundwater movement, Evaporation, *Groundwater-surface-water relationships, *Hydrogeology, *New Hampshire, Mirror Lake.

The drainage basin of Mirror Lake, New Hampshire is characterized by high knobs and ridges and steep land slopes. The lake is situated in the lower part of the basin, largely within glacial drift. Drift in most of the Mirror Lake drainage basin is till, which is as much as 50 meters thick, Crystalline bedrock underlying the drift is composed of schist, slate, and quartz monzonite of earliest Devonian age. These rocks are intensely folded and contain numerous fractures. Three small streams flow into Mirror Lake. Streamflow discharge into Mirror Lake differs between the two largest subbasins. Basin NW, which has a more round shape and thicker glacial drift than basin W, has greater stream discharge as well as greater sustained base flow. Ground water moves into most parts of

Mirror Lake, and losses to ground water occur principally on the southeast side. Water-level data from piezometers and bedrock wells indicate dynamic ground-water movement within the fractured bedrock underlying Mirror Lake. These data also indicate very active interchange of ground water between bedrock and the overlying glacial drift. There are particularly strong hydraulic head gradients from the bedrock into the drift in the area between Mirror Lake and Hubbard Brook. (USGS)
W86-02905

2I. Water In Plants

WETLANDS FOREST COMMUNITIES AS INDICATORS OF FLOODING POTENTIAL IN BACKWATER AREAS OF RIVER BOTTOMLANDS,
Arkansas Univ., Fayetteville. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 4C.
W86-02445

EFFECT OF HYDROPERIOD ON FLOODPLAIN FOREST PRODUCTION,
Georgia Univ., Athens. Inst. of Ecology.
J. B. Birch, and J. L. Cooley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214583/AS, Price codes: A06 in paper copy, A01 in microfiche. Technical Completion Report, Georgia Water Resources Research Center, Atlanta, May 1983. 98 p, 5 tab, 57 fig, 63 ref. OWRT B-155-GA(1). 14-34-0001-1216.

Descriptors: *Biomass, Flood adapted, *Flood plains, *Forests, *Hyroperiod, Moisture limited, Oxygen limited, *Productivity, *Subsidies, Subsidy-stress, Georgia.

Floodplain forest biomass production followed a bimodal gradient from the wettest to driest sites. The wettest sites were continually flooded and supported a bicultural water tupelo-baldcypress forest that was highly adapted through an extensive water-root system to constant flooding and periodic flushing by riverine floods. The wood production (6379 kg/ha/yr) of this forest was among the highest of the floodplain forests studied. The next wettest site was flooded much of the year, had waterlogged soil for much of the rest of the year, and had a drained soil surface for extended periods. This tupelo-baldcypress, 'root oxygen limited,' forest did not have a water-root system and had the lowest biomass production (3553 kg/ha/yr) of any of the forests studied. The sites that were flooded during some portion of the year but well drained during most of the growing season while maintaining a relatively available soil moisture level were the most productive (6883 kg/ha/yr) floodplain forests. The forest that was only slightly flooded each year by the highest floods had a much lower biomass production (4623 kg/ha/yr) than the heavily flooded and well drained forest. Sites subjected to intermediate levels of flooding and well drained soils had an intermediate level of biomass production (an average of 5240 kg/ha/yr). The upland hardwood, 'moisture limited' forest that is no longer flooded had a low biomass production (3677 kg/ha/yr) similar tt of the waterlogged soil, tupelo-baldcypress forest.
W86-02462

CHAPARRAL MANAGEMENT EFFECTS ON WATER AND THE ENVIRONMENT,
California Univ., Davis. Dept. of Agronomy and Range Science.
J. W. Menke, M. J. Singer, and R. R. Curry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225944/AS, Price codes: A04 in paper copy, A01 in microfiche. California Water Resources Center, Davis Completion Report, Sept. 1984. 50 p, 2 ref. USGS G830-22.

Descriptors: *Chaparral, *Literature review, *Vegetation effects, *Fire, *Vegetation regrowth, *Environmental effects, Reforestation, Revegetation, Watershed management, Watersheds, Incineration.

The document is a summary of a detailed survey of the literature on shrublands in California. It summarizes the results of a multi-disciplinary project to define what is currently known about shrubland vegetation management and what additional research is needed to properly assess the social and environmental effects of such management. Fire is the most important management tool, and therefore receives the most emphasis in the publication. A general treatment of management procedures and a description of the biogeography and prehistory of shrublands are presented in the initial chapters. The effects of shrubland management (primarily by fire) are presented next, with chapters on the effects on vegetation, on soils, on water yield and water quality, on streams (with particular emphasis on the organisms that live in the streams), and on wildlife. This is followed by a chapter on shrubland ecosystem dynamics. The final chapters in the document deal with management concerns, which include management of shrublands for livestock forage, the effects of burning on air quality, the economics and policy of shrubland management, and fire behavior and burning technology. (Snyder-California)
W86-02570

2J. Erosion and Sedimentation

FLOW PROPERTIES OF THE MT. ST. HELENS MUDFLOW MATERIAL,
Washington Univ., Seattle. Dept. of Geological Sciences.
J. D. Smith, T. Dunne, and L. H. Fairchild.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211829, Price codes: A05 in paper copy, A01 in microfiche. Project Completion Report, 1983. 74 p, 19 fig, 8 tab, 16 ref. C-00235-V(1). 14-34-0001-1411.

Descriptors: *Mudflows, *Volcanoes, *Washington, *Mt. St. Helens, *Toutle River, Sediments, Rheology, Viscosity, Yield strength.

Field measurements of average velocity and discharge of Toutle River lahars of May 18, 1980, are described and interpreted. North and South Fork lahars showed strong differences in timing, discharge, and attenuation. The South Fork lahar had a short duration annd high peak discharge which declined strongly down-valley. The North Fork lahar had much lower peak discharge and longer duration but suffered little attenuation. Field measurements on the North Fork lahar indicated a sediment concentration of approximately 65% by volume, and yield strength of 2100-2600 g/cm-sq S at or near peak flow. Videophotography suggested that flow was laminar where the lahar was undisturbed. Equivalent data could not be collected for the South Fork. Experimental lahars were run down a linear flume of rectangular cross section under one-dimensional flow conditions. Results showed a strong sensitivity of rheological properties to small changes in sediment concentration. The sediment in the experimental lahars was taken from deposits of the North Fork lahar 15 km from the lahar source and modified to remove clasts larger than 23 mm. A Bingham constitutive equation, comprising Bingham viscosity and yield strength, was chosen to represent lahar rheological properties. Results of the experiments showed that yield strength varied from 800 to 2900 g/cm-sq S for a 2.3% change in sediment concentration, and viscosity varied from 40 to 500 g/cm-s. Vertically subdivided samples taken from the moving flow to detect vertical stratification of the flows do not support a conclusion that the sediment was stratified.
W86-02453

LONG TERM SEDIMENT DEPOSITION IN THE RIPARIAN ZONE OF AN AGRICULTURAL WATERSHED,
Georgia Univ., Athens. Inst. of Ecology.
R. Lowrance, and J. Cooley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216950/AS, Price codes: A06 in paper copy, A01 in microfiche. Environmental Resources Center Report No. ERC 03-84, Georgia Institute of Technology, Atlanta, July 1984, 92 p, 2 tab, 1 fig, 51 ref. USGS G-836(05).

Descriptors: *Georgia, *Coastal plain watersheds, *Sediment transport, Water quality, Riparian ecosystems, Nonpoint source pollution, *Erosion, History of agriculture, *Sedimentation.

Sediment deposition over the past 100 years was measured on a coastal plain agricultural watershed. Watershed K, part of the Little River Research Watershed in Turner County, Georgia is 1666 ha comprised of 34 percent row crops, 59 percent forest, 2 percent pasture, and 5 percent other lands. The Wiregrass Bioregion, where the watershed is located, was settled in 1860-1890. Significant agricultural development did not begin until the 1880's. Three approaches were used to estimate long term sediment deposition: (1) determine the changes in depth to argillic horizon along transects from fields to streams; (2) estimate 10 year upland erosion with the Universal Soil Loss Equation and use a sediment delivery ratio to calculate mass of deposition; and (3) use radiometric dating techniques to estimate the ages of deposited materials. Estimates from the radiometric dating ranged from 0.8 to 3.4 cm/yr or about 128 Mg.ha-1.yr-1 to 544 Mg.ha-1.yr-1. Estimates of changes in depth to the argillic horizon along nine transects yielded a mean of 51.7 mg.ha-1.yr-1 with a range of 7.6 to 92.1 Mg.ha-1.yr-1. The average annual rate for the estimate of gross erosion minus sediment delivery was 34.8 Mg.ha-1.yr-1. From these data, we conclude that the average annual rate of sediment deposition on Watershed K during 1880-1979 was 35 to 52 Mg.ha-1.yr-1. The actual quantities at any one point can range much higher, perhaps up to 550 Mg.ha-1.yr-1. These data suggest that riparian ecosystems are important sinks for agricultural chemicals (nutrients and pesticides) associates with these sediments.
W86-02526

PREVENTION OF GULLY FORMATION AND ASSOCIATED WATER DEGRADATION IN WEST TENNESSEE,
Tennessee Water Resources Research Center, Knoxville.
C. H. Shelton, C. D. Tyler, and R. D. VonBernuth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217735/AS, Price codes: A03 in paper copy, A01 in microfiche. Research Report No. 102, September 1984. 39 p, 30 ref, 9 fig, 10 tab. USGS G870-04.

Descriptors: *Gully erosion, Rainfall, Rainfall simulators, *Soil erosion, *Sheet erosion, Soil density, Soil stability, *Tennessee.

A transportable non-intermittent rainfall simulator capable of producing intensities ranging from 76 to 168 mm/h with a minimum distribution uniformity of 84 percent was developed. Drop sizes, terminal velocities and impact angles were close to those of natural rainfall. In a test involving five cropping/tillage systems, maximum sediment concentration and total sediment yield ranged from 756 ppm and 0.04 t/ha, respectively, for a no-till system to 56,728 ppm and 4.00 t/ha for a conventionally-tilled system. In tests conducted to separate sheet erosion from rill and gully erosion, soil loss due to rill and gully was as much or more than that from sheet erosion. Sheet erosion tended to stabilize in time as soil became compacted, but rill and gully erosion continued. The depth of the gully was proportional to the time the gully was subjected to erosion, but inversely proportional to soil density.
W86-02538

STREAMBANK EROSION PROTECTION AND CHANNEL SCOUR MANIPULATION USING ROCKFILL DIKES AND GABIONS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8A.
W86-02665

WIND AND WIND WAVE SEDIMENT TRANSPORT IN LARGE LAKES AND RESERVOIRS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
W. G. McDougal, and C. P. Lee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-247989/AS, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Publication WRRI-99, Corvallis, September 1984. 26 p, 8 fig, 14 ref. USGS G864-08. 14-08-0001-G0864

Descriptors: *Wind waves, *Sediment transport, Erosion, *Bank erosion, *Beach erosion, Mathematic models, *Lakes, Reservoirs, Water currents.

A simple model had been proposed to examine the effect of wind and wind waves on shoreline erosion for large rivers and lakes. The technique employed for estimating waves is that developed by the U.S. Army Corps of Engineers for coastal zones. The solution for the combined wind and wave setup is based on radiation stress concepts, as is the generation of the longshore current. The sediment transport model is based on energetics. And finally, the shoreline evaluation model is based on conservation of sediment. The methodology and numerical results were produced for the first four tasks. Only the methodology was outlined for the fifth task. Without the completion of the fifth task, it is difficutl to quantify the effects of wind wave erosion on the shoreline. However, it is clear that the sediment transport is increased in a narrow band along the water line. Whether this sediment transport is of sufficient magnitude or duration to cause significant erosion remains unanswered.
W86-02678

BANK EROSION CONTRIBUTION TO STREAM SEDIMENT LOAD,
Iowa Inst. of Hydraulic Research, Iowa City.
A. J. Odgaard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101375/AS, Price codes: A06 in paper copy, A01 in microfiche. Iowa Water Resources Research Institute, Ames, Publication No. IIHR 280, August, 1984. 92 p, 24 fig, 20 tab, 26 ref, 3 append. USGS G-842-04. 14-08-0001-G-842.

Descriptors: *Iowa, *Stream bank erosion, *Mathematical models, Geomorphology, Alluvial River, *Sediment load, Bank erosion, Sediment transport, Suspended load.

Soil loss by instream bank erosion is analyzed. A conceptual model is developed which relates the rate of bank retreat to primary stream flow variables. Rates and processes of bank erosion are studied along two major rivers in Iowa. The study includes analysis of historical records (airphotos, maps, and streamflow records), field measurements, and laboratory soil tests. The data thus obtained are used, together with published data to calibrate the bank-erosion model, which is then used to estimate the rate at which bank material is being removed from the banks of other major streams in Iowa. These estimates are compared with the rate of suspended-sediment transport in the streams as determined from sediment-discharge data and stream-gaging records. It is estimated that 45 percent of the suspended sediment leaving the State of Iowa through its rivers originates from instream bank erosion along the main river channels.
W86-02718

SEDIMENT CONCENTRATIONS AND LOADS IN THE LOXAHATCHEE RIVER ESTUARY, FLORIDA, 1980-82,
Geological Survey, Miami, FL. Water Resources Div.
W. H. Sonntag, and B. F. McPherson.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4157, 1984. 30 p, 6 fig, 8 tab, 17 ref.

Descriptors: *Sediment transport, *Suspended load, *Bed load, Particle size, *Loxahatchee River estuary, *Florida.

This study was conducted to estimate the magnitude of sediment loads and the general spatial and temporal patterns of sediment transport in the Loxahatchee River estuary, Florida. Mean concentrations of suspended sediment generally were higher in the Jupiter Inlet area than in the remainder of the embayment area. Concentrations of suspended sediment varied with season and weather conditions. Concentrations in selected tributaries following Tropical Storm Dennis in August 1981 immediately increased as much as 16 times over concentrations before the storm. Suspended-sediment loads from the tributaries were also highly seasonal and storm related. During a 61-day period of above-average rainfall that included Tropical Storm Dennis, 5 major tributaries discharged 926 tons (short) of suspended sediment to the estuary, accounting for 74 percent of the input for the 1981 water year and 49 percent of the input for the 20-month study period. Suspended-sediment loads at Jupiter Inlet and at the mouth of the estuary embayment on both incoming and outgoing tides far exceeded tributary loads, but the direction of long-term, net tidal transport was not determined. (USGS)
W86-02797

SEDIMENT DATA FOR GEORGIA STREAMS, WATER YEARS 1958-82,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02821

ANNUAL SUSPENDED-SEDIMENT LOADS IN THE COLORADO RIVER NEAR CISCO, UTAH, 1930-82,
Geological Survey, Salt Lake City, UT. Water Resources Div.
K. R. Thompson.
Available from OFSS, USGS, Box 25425, Lakewood, Co 80225. USGS Water-Resources Investigations Report 85-4011, 1984. 19 p, 7 fig, 2 tab, 12 ref.

Descriptors: Sedimentation, Sediment transport, *Sediment discharge, *Sediment loads, Sediment, *Sediment rates, *Sediment yield, *Colorado River, Cisco, *Utah.

The Colorado River upstream of gaging station 09180500 near Cisco, Utah, drains about 24,100 square miles in Utah and Colorado. Altitudes in the basin range from 12,480 feet near the headwaters to 4,090 feet at station 09180500. The average annual precipitation for 1894-1982 near the station was 7.94 inches. The average annual precipitation near the headwaters often exceeds 50 inches. Rocks ranging in age from Precambrian to Holocene are exposed in the drainage basin upstream from station 09180500. Shale, limestone, siltstone, mudstone, and sandstone probably are the most easily eroded rocks in the basin, and they contribute large quantities of sediment to the Colorado River. During 1930-82, the U.S. Geological Survey collected records of fluvial sediment at station 09180500. Based on these records, the mean annual suspended-sediment load was 11,390,000 tone, ranging from 2,038,000 tons in water year 1981 to 35,700,000 tons in water year 1938. The minimum daily load of 14 tons was on August 22, 1960, and the maximum daily load of 2,790,000 tons was on October 14, 1941. (USGS)
W86-02828

SEDIMENT CHARACTERISTICS OF TENNESSEE STREAMS AND RESERVOIRS,
Geological Survey, Nashville, TN. Water Resources Div.
S. W. Trimble, and W. P. Carey.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-749, 1984. 32 p, 6 fig, 4 tab, 26 ref.

Descriptors: *Sediment yields, *Sediment transport, *Sediment concentrations, *Reservoir deposition, Trap efficiency, *Tennessee.

Measured suspended-sediment data and reservoir sedimentation data have been analyzed to determine sediment yields and transport characteristics of Tennessee streams. Measured suspended-sediment is mostly silt and clay size material even in the sand-bed channels of western Tennessee. Unmeasured load accounts for less than 10 percent of the total sediment load in western Tennessee. Unmeasured load in middle and eastern Tennessee streams is believed to be only a small percentage of total load because bed material is generally coarse and quite variable. Sediment of total load because bed material is generally coarse and quite variable. Sediment yields for middle and eastern Tennessee basins generally are less than 800 tons per square mile per year ((tons/mi2)/yr), however, highly disturbed basins can have yields from 1,000 to 3,000 (tons/mi2)/yr. Yields for the heavily agricultural and channelized basins of western Tennessee generally range from 700 to 1,000 (tons/mi2)/yr. Yields for the Hatchie River in western Tennessee are less than 200 (tons/mi2)/yr reflecting the lack of floodplain agriculture and channelization. (USGS)
W86-02829

VELOCITY PROFILE, WATER-SURFACE SLOPE, AND BED-MATERIAL SIZE FOR SELECTED STREAMS IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02852

STREAM CHANNEL RESPONSE TO THE JANUARY 3-5, 1982 STORM IN THE SANTA CRUZ MOUNTAINS, WEST CENTRAL CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
K. M. Nolan, D. C. Marron, and L. M. Collins.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-248, 1984. 48 p, 29 fig, 3 tab, 21 ref.

Descriptors: *Geomorphology, *Channel morphology, *California, Landslides, Sediment discharge, *Storm runoff, Santa Cruz Mountains, Channel changes, San Lorenzo River.

Intense rainfall on January 3-5, 1982 in the Santa Cruz Mountains, California caused high streamflow and widespread landsliding. Generalized channel response in the studied basins included scour in steep, low-order channels and moderate fill in higher order channels. Large volumes of channel fill were noted along some channels but this was limited to reaches that received large volumes of colluvium from debris flows and streamside debris slides. The local nature of these effects on channel geometry contrasts with widespread depositional effects observed following major storms in steep terrain in other parts of California. The morphology of most intermediate and high-order channels in the study area appear to have been formed at least as much by events with moderated recurrence intervals as by extreme events. Along low-order channels that were scoured and along isolated reaches of some intermediate and high-order channels where fill was severe, however, storm effects will probably persist for long periods of time. Since the localized effects of high magnitude storms can persist longer than the recurrence interval of the storms themselves, channel morphology throughout the area probably reflects the effects of a number of storms. (USGS)
W86-02858

STREAMFLOW AND SEDIMENT DATA COLLECTED AT SEVEN STREAM-GAGING STATIONS IN THE JAMES RIVER BASIN DOWNSTREAM FROM FORESTBURG, SOUTH DAKOTA, FROM OCT 1, 1982 - SEP 30, 1983,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02912

2K. Chemical Processes

PASSIVE FILMS ON IRON: THE MECHANISM OF BREAKDOWN IN CHLORIDE-CONTAINING SOLUTIONS,
Texas A and M Univ., College Station. Dept. of Chemistry.
For primary bibliographic entry see Field 8G.
W86-02438

GROUNDWATER QUALITY AND MINERAL DEPOSITS RELATIONSHIPS IN THE OZARK MOUNTAINS,
Arkansas Univ., Fayetteville. Dept. of Geology.
K. F. Steele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211779/AS, Price codes: A04 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project Completion Report, Pub. No. 109. 59 p, 10 fig, 15 tab. USGS G-829-03.

Descriptors: *Manganese, *Springs, *Water chemistry, Groundwater, Water quality, Mineralization, Trace elements, *Arkansas, Lead, Uranium.

Ninety-nine groundwater sites were sampled in northern Arkansas in order to determine the effect of local manganese, phosphate, pyrite, lead-zinc and uranium mineralization on the groundwater chemistry. Most of this study (75 springs) was concentrated in the Batesville manganese district. Hydrogeochemical exploration for these types of manganese deposits appears possible with 44 percent of the springs within 2000 feet of mineralization having anomalous metal concentrations (especially manganese). Because only a few springs were sampled in the remaining areas, the results are not conclusive; however, only the pyrite and small lead-zinc deposit would appear worthy of additional investigation. None of the springs appeared to have geothermal water. Eighteen of the springs exceed U.S. Public Health Service drinking water limits, but most only exceed manganese or iron limits. One spring exceeded the drinking water limits for lead. Thus, these carbonate spring waters are generally of good chemical quality.
W86-02448

CHARACTERIZATION OF ALUMINUM CHEMISTRY FOR ACID PRECIPITATION,
Vermont Univ., Burlington. Dept. of Civil and Mechanical Engineering.
For primary bibliographic entry see Field 2B.
W86-02458

GEOCHEMISTRY OF SALINE LAKES OF THE NORTHEASTERN YUKON FLATS, EAST CENTRAL ALASKA,
Alaska Univ., Fairbanks. Dept. of Geology and Geophysics.
D. B. Hawkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214708/AS, Price codes: A03 in paper copy, A01 in microfiche. Alaska Institute of Water Resources Completion Report I84.16, January 1985. Fairbanks, 30 p, 2 tab, 6 fig. USGS G827-04.

Descriptors: *Evaporites, Trona, *Hydrogeochemistry, Chemical divides, Muscovite, *Alaska, Water chemistry.

Above the Arctic Circle in the Yukon Flats of northeastern Alaska, shallow, brackish-water ponds are rimmed with evaporite minerals such as trona (NaHCO3-Na2 CO3). These ponds form in an area of Alaska characterized by an extreme continental climate with about six inches of precipitation annually. Evaporite formation occurs because evaporation exceeds inflow. In this study, the hydrogeochemistry of the waters of the Yukon Flats was investigated to determine the origin of the ponds and evaporite minerals. The ponds are brackish Mg-Na-HCO3-Cl waters. The nearby freshwater lakes and rivers are Ca-HCO3 waters. In the rivers, m Ca(+2) J 2m HCO3, and SO4 is relatively abundant. In the freshwater lakes, m Ca(+2) O 2m HCO3, and SO4 is almost absent. The pond-water compositions are such that trona and associated minerals must result on complete evaporation. Consideration of the Harvie-Eugster model for evaporite mineral formation suggests that were the river water to evaporate, sulfate minerals such as gypsum should result. No sulfates are observed in these evaporites. Evaporation of the freshwater lakes will first precipitate calcite and ultimately form trona. The change in relative concentrations of Ca(+2), HCO3, and SO4 in going from river water to lake water is critical and indicates that sulfate reduction accompanied by bicarbonate formation is an essential process that produces an excess of HCO3 over Ca(+2). This ultimately leads to the formation of trona. Once the chemical signature of the freshwater lakes is established, then trona must result on complete evaporation, as explained by the chemical divides of Harvie and Eugster.
W86-02473

WATERSHED INTERACTIONS AFFECTING POND ACIDIFICATION,
New Hampshire Univ., Durham. Water Resources Research Center.
D. C. Buso, S. W. Bailey, S. F. Baird, J. W. Hornbeck, and C. W. Martin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214955/AS, Price codes: A04 in paper copy, A01 in microfiche. Project Completion Report, (1984). 61 p, 20 fig, 8 tab, 79 ref. USGS G856-04.

Descriptors: *New Hampshire, *Acid rain, *Water pollution effects, Watersheds, Ponds, Aluminum.

Watershed history and geochemistry, and pond response to snowmelt were studied at six remote ponds in the White Mountains of New Hampshire. Changes in pond chemistry have resulted from watershed disturbances, particularly forest fires and beaver activities. These factors need to be considered in any evaluation of pond susceptibility to acidification. The relationships of pond chemistry to the hydrology and geochemistry of their watersheds were studied at Black and Cone Ponds. Deeper soils and more weatherable minerals in the watershed produces longer flow paths, higher pH, more basic cations, higher alkalinity, and lower SO 4 2- in the inlet stream of Black Pond. In contrast, the watershed at Cone Pond contained shallowere soils with minerals more resistant to weathering, producing shorter glow paths, lower pH, fewer basic cations, no alkalinity, and higher SO4 2- in theinlet stream. Acidic Cone Pond was intensively samples in late winter to follow changes in water chemistry that resulted from 'acid pulses' during snowmelt. During thaws the mass of H+ hydragenion in the pond increased but large changes wer not permanent and were confined to surface waters. Under conditions of winter stratification the bottom 2 m became much less acidic because of anoxic SO reduction. Characterization of acid buffering capacity of a pond should be based on detailed knowledge of watershed disturbances, hydrology, mineralogy, and pond chemistry.
W86-02498

KINETIC STUDY OF THE EFFECTS OF ACID RAIN ON TRACE METAL UPTAKE,
Maine Univ. at Orono. Dept. of Chemistry.
H. H. Patterson, D. Huizenga, and T. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215143/AS, Price codes: A05 in paper copy, A01 in microfiche. Maine Water Resources Institue Completion Report, Orono, November 1984. 72 p, 19 fig, 4 tab, 23 ref. USGS G846-05.

Descriptors: *Acid rain *Adsorption, *Chromium, Kinetics, *Maine, *Path of pollutants, Rate of pollutants, Water chemistry, Groundwater pollution.

The technique of chemiluminescence has been used to study the rate of reaction of the model species Cr(III) with an iron oxide surface as a function of pH. Both adsorption and desorption studies indicate that the mechanism of reaction of Cr(III) with iron oxide is similar to that observed for reactions of Cr(III) with anions in solution. Chemiluminescence experiments have also been done to determine the rate of reaction of Cr(III) with simple carboxylic acids such as oxalic acid, salicylic acid, and acetic acid, as well as with humic acid samples. At low pH oxalic acid and humic react at a similar rate but at higher pH (>5) differences in these two systems occur. Carboxylate groups in humic acid that ionize at higher pH are more reactive than those which ionize at lower pH either because of nearby functional groups or because of a specific geometry. Synchronous scan fluorescence spectroscopy was used to probe the binding of a variety of metal species with model systems and with humic and fulvic acid samples. The three different emission peaks for humic acid can be correlated with different molecular weight components. The highest energy peak is probably derived from benzene derivatives while the longest wavelength peak is associated with an eight pi-bond conjugated species which is sensitive to metal binding. The purpose of these studies is to compare the binding of a model metal species, such as Cr(III), with iron oxide, simple carboxylic acids and humic acid samples. These results should provide insight into the dynamic pathways of metals in aqueous systems and the effects of acid rain, or pH changes, on these pathways.
W86-02517

PROCESSES CONTROLLING THE COMPOSITION OF INFILTRATING WATER IN FORESTED MOUNTAIN WATERSHEDS,
Wyoming Univ., Laramie. Coll. of Arts and Sciences.
J. I. Drever, and A. E. Blum.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-226306/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, Wyoming Water Research Center, Laramie, August 1984. 54 p, 5 tab, 13 fig, 32 ref. USGS G879-04.

Descriptors: *Wyoming, *Water chemistry, *Forest hydrology, *Surface-groundwater relations, *Acid rain, Soil chemistry, Infiltration, Weathering, Nutrients.

Chemical weathering in a high-elevation pine forest was studied by analysis of percolating soil solutions and associated solid phases. In the shallow soil (above 40 cm), soil-water chemistry is controlled by biological processes-uptake by plants and decay in the litter layer. Below 40 cm mineral weathering becomes more important as a control, but solution compositions are so variable in space and time that it is impossible to define a simple weathering stoichiometry. Kaolinite is forming in the upper part of the soil profile and smectite in the lower part, although solution compositions indicate that kaolinite should be the more stable phase at all depths. Dissolved organic carbon (DOC) values are high (average 38 mgC/1) in the forest floor litter, and decrease with depth in the mineral soil. In clay-rich, low-permeability soil the DOC loss and acquisition of cations take place close to the surface, whereas in more permeable soild DOC transport and chemical weathering extend to greater depths. There is some enhanced transport of Al Fe as a result of complexing by organic acids. The mechanisms by which DOC is removed from solution are not clear.
W86-02577

NEW APPROACHES FOR ON-LINE STRIPPING ANALYSIS OF TRACE METALS IN NATURAL WATERS,
New Mexico State Univ., Las Cruces. Dept. of Chemistry
J. Wang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-229797/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, New Mexico Water Resources Research Institute, Las Cruces, October 1984. 21 p, 13 fig, 10 ref. USGS G858-03.

Descriptors: *Water chemistry, *Water analysis, *New Mexico, Trace metals, *Chemical analysis, Natural waters, Flow system.

This report summarizes progress made on developing new methodologies for on-line measurements of trace metals in natural waters using stripping analysis. Such measurements have the advantage of giving immediate answers, and avoids the errors and delays associated with laboratory measurments. Dualworking electrode cells have been designed to eliminate problems due to dissolved oxygen, intermetallic compounds, and overlapping peaks. The large hydrogen background current that obscures the zinc peak has been corrected using the medium-exchange approach. A new scheme for on-line measurement of arsenic using a gold working electrode has been developed. New detector configurations based on supplementary forced-convection have been found useful for enhancing the sensitivity. Additional improvement in the sensitivity has been achieved using the subtractive mode that corrects for all background current contributions. Flow injection systems permit automated quantitation of trace metal at the ppb level at a rate of 24 samples per hours.
W86-02608

ADSORPTION OF METAL IONS AND MINERAL COMPLEXES ON MINERALS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
J. G. Dillard, D. L. Crowther, and C. V. Schenck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-242931/AS, Price codes: A07 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Blacksburg, Bulletin No. 141, June, 1984. 133 p, 29 fig, 32 tab, 46 ref. OWRT B-119-VA.

Descriptors: *Adsorption, *Montmorillonite, *Manganese, *Cobalt, Amino acids, X-ray spectroscopy, Electrophoresis, Metal complexes, Clay minerals, Substrates, Hydrolysis, Oxidation, Chemical analysis, Chemical structure, Organic compounds, Ions, Minerals.

Certain substrates, including natural water systems, act as a sink for metal ions. A better description of the bonding of metal ions with minerals is important for understanding both the chemical processes of metal ion-mineral interactions and the influence of mineral substrates on the concentration of metal ions in natural water systems. This study investigated the reactions of cobalt(II) and cobalt(III) organic complexes with montmorillonite and synthetic birnessite (Mn02) surfaces. These solid materials were selected as typical of minerals which interact with metal ions and organic-metal complexes in natural water systems. The studies provided a detailed chemical description of the nature of the surface species. Surface characterization included x-ray photoelectron spectroscopy, electrophorectic mobility, and infrared and visible spectroscopy. Results described the chemical oxidation state of the adsorbed metal and gave the chemical stoichiometry of the surface adsorbates. Evidence showed that metal complexes interacted with clay mineral surfaces through dissociative hydrolytic processes, and metal ion and metal-ion complexes probable reaction processes for the dissociative hydrolytic processes. Elucidation of the detailed surface chemistry is useful in modeling and understanding the specific interactions that occur when metal ions and metal-organic compounds react with mineral substrates.
W86-02662

ACID RAIN BUFFERING POTENTIAL IN OREGON CASCADE LAKES: SECONDARY MINERAL SOLUBILITY CONTROL OF SOLUTION IONIC COMPOSITION,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-02667

FEASIBILITY OF DIRECT UTILIZATION OF SELECTED GEOTHERMAL WATER FOR AQUACULTURE OF MACROBRACHIUM ROSENBERGII,
Boise State Univ., ID. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2F.
W86-02691

SELECTIVE ISOLATION OF DISSOLVED ORGANIC MATTER FROM AQUATIC SYSTEMS,
Illinois State Water Survey Div., Champaign.
J. R. Tuschall, and G. George.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249688/AS, Price codes: A03 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana-Champaign, Research Report No 190, June 1984. 40 p, 7 fig, 7 tab, 55 ref. USGS G840-05. 14-08-0001-G840.

Descriptors: Amino acids, Ammonia, *Analytical techniques, *Anion exchange, Bogs, Carbon, Cation exchange, Chemical properties, Chromatography, *Decomposing organic matter, Dissolved organic matter, DON, Fluorometry, Fulvic acids, Humates, Humic acids, Humus, Isolation, *Lakes, Liquid chromatography, Nitrogen, *Organic matter, Ponds, *Separation techniques, Streams, *Surface waters, Swamps, *Water chemistry, Wetlands, XAD resins.

A chromatographic ion-exchange procedure for fractionation, isolation and concentration of dissolved organic matter (DOM) in surface waters was developed and applied to samples from Illinois lakes. Recoveries of DOM from five humic-containing (colored) surface waters were in excess of 90%. A series of experiments using model compounds demonstrated that the mechanism of sorption of the acidic fraction, and of its recovery by controlled desorption, is simple ion exchange. Hydrophobic (nonpolar) interactions did not affect sorption processes. Filtered water samples were applied to a fractionation scheme to separate the DOM into anion exchanged (acidic), cation exchanged (basic) and nonexchanged (neutral) fractions. Of the DOM, most of the dissolved organic carbon and a large portion of dissolved organic nitrogen (DON) in all samples was recovered in the acidic fraction, with the neutral fraction containing most of the remaining DOM. The cationic (at pH 3) fraction contained a lower portion of the DOM than expected. DON was monitored throughout the fractionation scheme by a sensitive fluorescence method developed in this study and generally applicable to measuring small samples containing low concentrations of DON found in natural waters. This fractionation scheme is a useful tool for researchers studying the chemical nature of dissolved organic matter, which affects water quality in many ways.
W86-02700

ADSORPTION OF METAL IONS AND MINERAL COMPLEXES ON MINERALS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
J. G. Dillard, D. L. Crowther, and C. V. Schenck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101342/AS, Price codes: A07 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Blacksburg, Bulletin No 141, June, 1984. 133 p, 29 fig, 32 tab, 46 ref. B-119-VA.

Descriptors: *Adsorption, *Montmorillonite, *Manganese, *Cobalt, Amino acids, X-ray spectroscopy, Electrophoresis, Metal complexes, Clay minerals, Substrates, Hydrolysis, Oxidation, Chemical analysis, Chemical structure, Organic compounds, Ions, Minerals.

Certain substrates, including natural water systems, act as a sink for metal ions. A better description of the bonding of metal ions with minerals is important for understanding both the chemical processes of metal ion-mineral interactions and the influence of mineral substrates on the concentration of metal ions in natural water systems. This study investigated the reactions of cobalt(II) and cobalt(III) organic complexes with montmorillonite and synthetic birnessite (MnO2) surfaces. These solid materials were selected as typical of minerals which interact with metal ions and organic-metal complexes in natural water systems. The studies provided a detailed chemical description of the nature of the surface species. Surface characterization included x-ray photoelectron spectroscopy, electrophoretic mobility, and infrared and visible spectroscopy. Results described the chemical oxidation state of the adsorbed metal and gave the chemical stoichiometry of the surface adsorbates. Evidence showed that metal complexes interacted with clay mineral surfaces through dissociative hydrolytic processes, and metal ion and metal-ion complexes oxidized when adsorbed on the MnO2 surface. Further, the study presented probable reaction processes for the dissociative hydrolytic processes. Elucidation of the detailed surface chemistry is useful in modeling and understanding the specific interactions that occur when metal ions and metal-organic compounds react with mineral substrates. (McWilliams-VWRRC)
W86-02715

RECONNAISSANCE OF TOXIC SUBSTANCES IN THE JORDAN RIVER, SALT LAKE COUNTY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-02766

WATER-QUALITY CHARACTERISTICS OF STREAMS IN THE PICEANCE CREEK AND YELLOW CREEK DRAINAGE BASINS, NORTHWESTERN COLORADO,
Geological Survey, Meeker, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02767

RECONNAISSANCE OF CHEMICAL QUALITY OF SURFACE WATER IN THE UPPER VIRGIN RIVER BASIN, UTAH, ARIZONA, AND NEVADA,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02768

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, OREGON,
Geological Survey, Lakewood, CO. Water Resources Div.
T. H. Thompson, R. Chappell, J. B. Gonthier, and W. D. McFarland.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4120-C, 1984. 5 p, 13 ref.

Descriptors: *Groundwater, Water quality data, *Groundwater quality, *Basin and Range province, *Oregon, *Maps, *Dissolved solids.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps at a scale of 1:500,000 that describe the ground-water quality of the Oregon portion of the Basin and Range province. The first map shows the areal distribution of dissolved solids in water in the basin-fill deposits. The second map shows the areal distribution of the dominant chemical type of ground water in the basin-fill deposits. (USGS)
W86-02800

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND PROVINCE, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
T. H. Thompson, R. Chappell, J. R. Harrill, and A. H. Welch.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4119-C, 1984. 11p, 4 fig, 49 ref.

Descriptors: *Groundwater, *Water quality data, *Groundwater quality, Aquifers, *Basin and Range province, *Nevada, *Maps, *Dissolved solids.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps at a scale of 1:500,000 describing the ground-water quality of the Nevada part of the Basin and Range province. The first map shows the areal distribution of dissolved solids of ground water in the basin-fill deposits. Data from selected points are also shown in both basin-fill and consolidated rock. The second map shows the areal distribution of the dominant chemical type of ground water in the basin-fill deposits. Data from selected points are also shown in both basin-fill and consolidated rock. (USGS)
W86-02801

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
T. H. Thompson, J. A. Nuter, and A. H. Welch.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4122-C, 1984. 7 p, 4 fig, 28 ref.

Descriptors: Groundwater, Water quality data, *Groundwater quality, Hydrogeology, *Basin and Range Province, *Utah, *Maps, *Dissolved solids.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range Province. The report consists of two maps at a scale of 1:500,000 describing the ground-water quality of the Utah part of the Basin and Range Province. The first map shows the areal distribution of dissolved solids of ground water in the basin-fill deposits. The second map shows the areal distribution of the dominant chemical type of ground water in the basin-fill deposits. (USGS)
W86-02802

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, ARIZONA,
Geological Survey, Lakewood, CO. Water Resources Div.
T. H. Thompson, J. A. Nuter, and T. W. Anderson.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4114-C, 1984. 7 p, 4 fig, 24 ref.

Descriptors: *Groundwater, Water quality data, *Groundwater quality, *Basin and Range Province, *Arizona, Hydrogeology, *Maps, *Dissolved solids.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range Province. The report consists of two maps at a scale of 1:500,000 describing the ground-water quality of the Arizona portion of the Basin and Range Province. The first map shows the areal distribution of dissolved solids of ground water in the basin-fill deposits. The second map shows the areal distribution of the dominant chemical types of ground water in the basin-fill deposits. (USGS)
W86-02803

PARTIAL COMPILATION AND REVISION OF BASIC DATA IN THE WATEQ PROGRAMS,
Geological Survey, Menlo Park, CA. Water Resources Div.
D. K. Nordstrom, S. D. Valentine, J. W. Plummer, and B. F. Jones.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4186, 1984. 18 p, 1 fig, 6 tab, 44 ref.

Descriptors: *Computer programs, *Thermodynamics, *Experimental data, Data collections, *Water chemistry, Water quality, Aluminum hydrolysis, Ion pairs, Ferrous, Ferric gibbsite.

Several portions of the basic data in the WATEQ series of computer programs (WATEQ, WATEQF, WATEQ2, WATEQ3, and PHREEQE) are compiled. The density and dielectric constant of water and their temperature dependence are evaluated for the purpose of updating the Debye-Huckel solvent parameters in the activity coefficient equations. The standard state thermodynamic properties of the Fe2+ and Fe3+ aqueous ions are refined. The main portion of this report is a comprehensive listing of aluminum hydrolysis constants, aluminum fluoride, aluminum sulfate, calcium chloride, magnesium chloride, potassium sulfate and sodium sulfate stability constants, solubility product constants for gibbsite and amorphous aluminum hydroxide, and the standard electrode potentials for Fe (s)/Fe2+(aq) and Fe2+(aq)/Fe3+(aq). (USGS)
W86-02816

QUALITY OF WATER FROM BEDROCK AQUIFERS IN THE SOUTH CAROLINA PIEDMONT,
Geological Survey, Columbia, SC. Water Resources Div.
G. G. Patterson, and G. G. Padgett.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resource Investigations Report 84-4028, 1984. 24 p, 15 fig, 8 ref.

Descriptors: *Groundwater, *Geochemistry, *Water quality, Crystalline rocks, Bedrock, *Hydrologic maps, Geology, *South Carolina, Piedmont.

The geographic distributions of 12 common water-quality parameters of ground water from bedrock aquifers in the Piedmont physiographic province of South Carolina are presented in a series of maps. The maps are based on analyses by the South Carolina Department of Health and Environmental Control of water samples taken during the period 1972 to 1982 from 442 public and private wells developed in the Piedmont. In general, alkalinity, hardness, and concentrations of sodium, magnesium, and chloride were higher in the Carolina Slate Belt than they were in the other geologic belts of the Piedmont. (USGS)
W86-02823

QUALITY-ASSURANCE DATA FOR ROUTINE WATER ANALYSIS IN THE LABORATORIES OF THE U.S. GEOLOGICAL SURVEY FOR WATER-YEAR 1983,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-02834

OCCURRENCE OF NATURAL RADIUM-226 RADIOACTIVITY IN GROUND WATER OF SARASOTA COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02861

GEOHYDROLOGY AND CHEMICAL QUALITY OF WATER IN UPPER JURASSIC AND LOWER CRETACEOUS ROCKS, WESTERN KANSAS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02868

STATISTICAL SUMMARY OF DAILY VALUES DATA AND TREND ANALYSIS OF DISSOLVED-OXYGEN DATA AT NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN) STATIONS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-02873

2L. Estuaries

NUTRIENT ASSIMILATION CAPACITY OF SHALLOW COASTAL LAKES,
Louisiana Water Resources Research Inst., Baton Rouge.
For primary bibliographic entry see Field 5C.
W86-02547

EFFECT OF SALTWATER INTRUSION ON SOIL ERODIBILITY OF ALABAMA MARSHLAND,
Auburn Univ., AL. Dept. of Civil Engineering.
S. R. Jenkins, and R. K. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-219053/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, Alabama Water Resources Research Institute, Auburn, September 1984. 37 p, 24 ref, 1 fig, 5 tab. USGS G880-05.

Descriptors: *Erosion, *Salinity, *Marshlands, *Saltwater intrusion, Cohesive soil, Straight channel flumes, Coagulation, Soil stability, Double-layer theory, Specific chemical interaction, *Alabama.

A straight-channel, branch-scale, recirculating flume was found to satisfactorily measure the gross effect of increasing total salt concentration on cohesive soil erodibility at a high degree of statistical significance. Remolded cohesive marshland soils from South Alabama demonstrated increased stability and resistance to erosion with increases in eroding fluid total salt concentration. The mechanism which controls this phenomenon remains unclear. Further research is needed to definitively establish the effects of double layer compaction, specific chemical interaction, and osmotic swelling on the soil stability.
W86-02552

CHANNEL AND FLOW RELATIONSHIPS IN TIDAL SALT MARSH WETLANDS,
California Univ., Berkeley. Dept. of Geology and Geophysics.
L. B. Leopold, L. Collins, and M. Inbar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225902/AS, Price codes: A02 in paper copy, A01 in microfiche. California Water Resources Center Completion Report, Davis, September 1984. 15 p, 6 fig, 1 tab, 4 ref. USGS G830-06.

Descriptors: *Channel morphology, *Salt marshes, *Wetlands, *Tidal marshes, *Sloping waves, Channels, Marshes, Velocity, Sediment, Vegetation, Spartina, *California.

In a natural tidal channel in Tule Slough, Petaluma Marsh bordering the Petaluma River north of San Pablo Bay, synoptic measurements of stage annd velocity were made at 7 locations along the 3 mile length of the channel. The purpose was to measure gage height and velocity simultaneously at several points along the channel and at different tide cycles. From such synoptic measurements water surface slope could be computed for different reaches of the channel from head to mouth. The data show that the curve of slope with time is not sinusoidal as had been previously reported. Rather slope remains constant in some reaches for many hours. Velocity is closely associated with slope in the reach. The hydraulic geometry of this pickleweed estuary differs from any previously reported. It is postulated that the important differences between this and spartina marshes is due to the type of sediment available to build and maintain the marsh. Petaluma Marsh is underlain by very fine clay mixed with peat or organic humus. The texture of the sediment and character of the vegetation lead to peculiar channel morphology and hydraulic action. As a result of the study it is suggested that the character of channels in other pickleweed marshes be compared with that of Spartina marshes. These differences could have significance in the task of restoring diked or

drained marshes in the Pacific Coast area. (Snyder-California)
W86-02566

SEDIMENT-WATER COLUMN EXCHANGES OF NUTRIENTS AND OXYGEN IN THE TIDAL JAMES AND APPOMATTOX RIVERS,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5B.
W86-02660

SEDIMENT CONCENTRATIONS AND LOADS IN THE LOXAHATCHEE RIVER ESTUARY, FLORIDA, 1980-82,
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-02797

HYDROLOGY OF MAJOR ESTUARIES AND SOUNDS OF NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
G. L. Giese, H. B. Wilder, and G. G. Parker.
Available from Dist Branch, USGS 604 S. Pickett St., Alexandria, VA 22034. USGS Water-Supply Paper 2221, 1985. 108 p, 1 pl, 96 fig, 14 tab, 79 ref.

Descriptors: *North Carolina, *Estuaries, *Sounds, Bays, Hydrology, Marshes, Rivers, Streamflow, Tides, *Saline water intrusion, *Water quality.

Hydrology-related problems associated with North Carolina's major estuaries and sounds include contamination of some estuaries with municipal and industrial wastes and drainage from adjacent, intensively farmed areas, and nuisance-level algal blooms. In addition, there is excessive shoaling in some navigation channels, salt-water intrusion into usually fresh estuarine reaches, too high or too-low salinities in nursery areas for various estuarine species, and flood damage due to hurricanes. The Cape Fear River is the only major North Carolina estuary having a direct connection to the sea. Short-term flow throughout most of its length is dominated by ocean tides. Freshwater entering the major estuaries is, where not contaminated, of acceptable quality for drinking with minimum treatment. However, iron concentrations in excess of 0.3 milligrams per liter sometimes occur and water draining from swampy areas along the Coastal Plain is often highly colored, but these problems may be remedied with proper treatment. Nuisance-level algal blooms have been a recurring problem on the lower estuarine reaches of the Neuse, Tar-Pamlico, and Chowan Rivers where nutrients (compounds of phosphorous and nitrogen) are abundant. The most destructive blooms tend to occur in the summer months during periods of low freshwater discharge and relatively high water temperatures. Saltwater intrusion occurs from time to time in all major estuaries except the Roanoke River, where releases from Roanoke Rapids Lake and other reservoirs during otherwise low-flow periods effectively block saline water from the estuary. New shoaling materials found in the lower channelized reaches of the Cape Fear and Northeast Cape Fear Rivers are primarily derived, not from upstream sources, but from nearby shore erosion, from slumping of material adjacent to the dredged channels, from old spoil areas, or from ocean-derived sediments carried upstream by near-bottom density currents. (USGS)
W86-02842

SEAWATER INTRUSION INTO COASTAL AQUIFER IN WASHINGTON, 1978,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02882

SALINITY CHARACTERISTICS AND DISTRIBUTION AND EFFECTS OF ALTERNATIVE PLANS FOR FRESHWATER WITHDRAWAL, LITTLE MANATEE RIVER ESTUARY AND ADJACENT AREAS OF TAMPA BAY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
M. Fernandez.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4301, 1985. 45 p, 22 fig, 10 tab, 14 ref.

Descriptors: *Saline-freshwater interface, *Estuaries, Regression analysis, *Saline water intrusion, Plant populations, *Florida, *Little Manatee River, Estuarine indicator plants, Riverine indicator plants.

The Little Manatee River, a coastal stream that empties into Tampa Bay, Florida, may be used as a source of freshwater. Reduction of streamflow will result in upstream movement of saltwater in the stream. Data on streamflow, tide stage, and specific conductance describe the salinity distribution of the estuary. Vertical conductivity profiles indicate that the river is vertically homogeneous during low flow. The maximum upstream location of the saltwater-freshwater interface (800 micromhos) in the river was described by multiple regression analysis involving mean daily streamflow and high-high tide. The coefficient of determination is 0.94 with a root mean square error of + or - 0.4 mile. The location on the river where the estuarine system ends and the riverine system begins is at about 9.9 miles above the reference station at Shell Point. Duration analysis of conductivity indicates that the maximum upstream location of the interface exceeded 9.7 miles about 17 percent of the days for the period of study. Reduction by 50 percent of streamflow for the 90day, 2-year and 20-year recurrence-interval low flow would relocate the maximum intrusion of the interface at the 2-year and 20-year flows upstream by 0.7 and 0.2 mile, respectively. (USGS)
W86-02883

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

INVESTIGATION OF METHODS FOR THE IMPROVEMENT OF THE ABSORPTION FREEZE PILOT PLANT OPERATION,
Burns and Roe Industrial Services Corp., Paramus, NJ.
For primary bibliographic entry see Field 5D.
W86-02422

NOVEL POLYMERS IN ASYMMETRIC AND COMPOSITE MEMBRANES,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
I. Cabasso, D. Vofsi, H. Tsai, T. Makenzie, and E. Gardiner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233955/AS, Price codes: A09 in paper copy, A01 in microfiche. Final Report, 1984. 141 p, 55 fig, 22 tab, 37 ref, append. OWRT C-10012-S(1). 14-34-0001-1442.

Descriptors: *Desalination, Hollow fibers, *Membranes, *Reverse osmosis, Polysulfone, Cellulose acetate, Cellulose triacetate, Poly(vinyl pyrrolidone), Polyphosphonate, Polymer blends, Alloys.

Several aspects of reverse osmosis membrane polymers were investigated, including successful production of polysulfone and cellulose triacetate hollow fiber membranes and cellulose acetate, poly(phenylene oxide phosphonate) and related polymer blend membranes. This report covers research on some outstanding problems concerning the compatibility of polysulfone with poly(vinyl pyrrolidone), hydrolysis and durability of PPN/CA membrane, identification of cellulose acetate structures that would yield compatible alloy membranes, and durability problems of cellulose triacetate hollow fibers operating under stress for sea water desalination. Included in this report are complete descriptions and evaluations of the synthesis and membrane casting method of novel polymers, poly(phosphono acetal) and several polyelectrolyte membranes, some of which display high flux and salt separation in initial RO-testing and will be studied further.
W86-02656

NONFOULING COATINGS FOR THIN FILM COMPOSITE MEMBRANES,
FilmTec Corp., Minneapolis, MN.
J-Y. Koo, J. M. Reitz, J. E. Cadotte, and R. J. Petersen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-247971/AS, Price codes: A06 in paper copy, A01 in microfiche. Final Report, March 1985. 96 p, 13 fig, 33 tab, 20 ref. 14-08-0001-22888.

Descriptors: *Reverse osmosis, *Semipermeable membranes, *Fouling, Permselective membranes, Membrane processes, Desalination.

Polymers containing sulfonate groups were synthesized and evaluated as fouling-resistant coatings for reverse osmosis membranes. The FilmTec FT-30 membrane was used as the substrate. Best results were obtained with a coating of poly(sodium stryenesulfonate-co-chloromethyl-styrene) crosslinked with an acid catalyst. In laboratory tests with feedwaters containing tannic acid, this coating showed much lower fouling rates compared with uncoated FT-30 controls. However, initial membrane fluxes were also lowered considerably just by the act of applying this coating, so that comparative fluxes of the final fouled membranes were not particularly different. For example, using a standardized test condition (200 psi, 25C, 0.2 percent sodium chloride feed containing 500 ppm tannic acid, pH adjusted with phosphoric acid, 18 hour test), uncoated FT-30 controls exhibited a typical initial flux of 15 gfd and final flux of 5.5 gfd; coated membranes showed a typical initial flux of 11 gfd and a final flux of 6.0 gfd. Similar behavior was observed in spiral element trials on humic-acid-laden river water. Overall results indicated that a sulfonate-rich hydrophilic coating on a reverse osmosis membrane did not confer a significant level of resistance toward fouling by humic or tannic acid colloids.
W86-02677

DEVELOPMENT OF A LOW PRESSURE HOLLOW FIBER REVERSE OSMOSIS MEMBRANE UTILIZING INTERNAL FLOW FOR USE ON A LOW SALINITY WATER,
Romicon, Inc., Woburn, MA.
J. G. Vouros, and A. J. Testa.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-126141/AS, Price codes: A07 in paper copy, A01 in microfiche. Final Report, (1985). 117 p, 49 tab, 27 fig. 14-34-0001-0445.

Descriptors: *Reverse osmosis, *Membranes, *Desalination, Thin film composite membrane, Hollow fibers, *Acrylic membrane, Chlorine resistance.

An acrylic membrane prepared by crosslinking hydroxyethyl methacrylate-methacrylic acid copolymer on a flat sheet microporous support exhibited excellent chlorine resistance, 95% sodium chloride rejection and 20 gal/ft2-day flux at 250 psi pressure. Polysulfone hollow fibers utilizing internal flow with inside diameters of 1.1 mm have been developed as composite membrane supports to operate continuously at 250 psi pressure. The acrylic thin film composite membrane was deposited on the inside surface of these polysulfone fiber supports and produced a composite membrane that yielded excellent chlorine stability, 70% sodium chloride rejection and 20 gal/ft2-day flux at 250 psi operating pressure. This membrane also exhibited cleanability via Romicon's conventional permeate backflushing and reverse flow techniques without experiencing performance degradation.
W86-02724

FOULING OF REVERSE OSMOSIS SYSTEMS,
Massachusetts Inst. of Tech., Cambridge. Dept. of

Mechanical Engineering.
R. F. Probstein, and R. D. Cohen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-126182/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Report, November 8, 1985. 34 p, 15 fig, 3 tab, 14 ref. 14-08-0001-g-1058.

Descriptors: *Reverse osmosis, *Fouling, *Membrane fouling, *Colloidal fouling, *Flux decline, *Laminar flow, Foulant growth, Permeation velocity, Transmembrane flux, Ferric hydroxide fouling, Cellulose acetate membranes, *Desalination.

A theoretical model of the fouling of reverse osmosis membranes by colloidal material has been developed for laminar flow and compared with the experimental results of fouling of cellulose acetate membranes by colloidal ferric hydroxide. The model is one-dimensional, based on the observation that laminar flow does not affect the foulant growth behavior. A fast initial reaction dominated fouling regime is predicted, followed very shortly in time by a much slower flux driven deposition, as confirmed experimentally by a slow linear flux decline. The data have also shown that if the ferric hydroxide is stabilized the flux decline rate is linear in the feed concentration, as predicted by the model. An unstable solution leads to a non-linear dependence of foulant deposition on foulant feed concentration. An important experimental finding is that there exists a threshold transmembrane velocity, on the order of 0.0005 cm/sec, below which no flux decline or fouling is observed. The origin of this threshold velocity is believed to result from surface charge and double layer interactions. The important conclusion is that in reverse osmosis systems fouling may be prevented simply by stabilizing the colloid solution and operating below the threshold permeation velocity.
W86-02728

3B. Water Yield Improvement

COMPARISON OF FRESHWATER USE CUSTOMS ON ULITHI ATOLL WITH THOSE OF SELECTED OTHER MICRONESIAN ATOLLS,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
R. A. Stephenson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227338/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. 51, August 1984. 33 p, 1 fig, 5 tab, 14 ref. USGS G837-03.

Descriptors: *Water use, *Water allocation, *Drought, *Atolls, *Social aspects, *Tropical regions, Rural areas, Water harvesting, Catchments areas, Water storage, Dug wells.

Freshwater catchment, storage, and distribution systems, along with fresh water use customs, in particular areas of Micronesia are discussed. Special attention is paid to Ulithi Atoll in the Western Caroline Islands. The average annual rainfall on atoll islands of Micronesia is high (over 100 inches). There are also significant groundwater resources. However, severe water shortages are often experienced, especially during the dry season. Water use customs that differ from those of Western nations often account for these difficulties. The field work was undertaken at a time of drought conditions on Ulithi, at the end of the dry season in June, 1983. True freshwater shortages were apparent, but Ulithians carried out a variety of coping strategies that made the impact of the drought less severe. These included a strong sense of community spirit, with the sharing of community resources as an everyday way of life. In this way, Ulithi differed from the communities of Laura and Nama studied earlier by the same research team.
W86-02598

IMPACT OF IMPROVED AGRICULTURAL WATER USE EFFICIENCY ON RESERVOIR STORAGE IN SUB-HUMID AREAS,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3F.
W86-02648

EFFECTS OF VARIOUS FACTORS ON THE SIZING OF RAIN WATER CISTERN SYSTEMS,
Caribbean Research Inst., St. Thomas, VI.
H. H. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233724/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 19, Virgin Islands Water Resources Center, St. Thomas, Sept 1984. 31 p, 11 fig, 2 tab, 29 ref, 2 append. USGS G875-06. 14-08-0001-G-875.

Descriptors: *Rain water harvesting, *Cisterns, Water tanks, Rain water, Water harvesting, *Virgin Islands.

The sizing of rain water cistern systems is properly done by considering several factors. Among these are rainfall frequency, duration and magnitude, demand on the system, characteristics of the catchment area, and the reliability level desired. Models developed in this study consider these factors. Results of simulation varying all of these factors show the changes in volume storage which must be provided. The models demonstrate their usefulness in the proper sizing of cistern systems to satisfy the peculiarities of specific situations.
W86-02650

3C. Use Of Water Of Impaired Quality

COMPARISON OF METABOLIC INHIBITORS, FILM-FORMING ANTITRANSPIRANTS, AND MICROJECT IRRIGATION FOR WATER USE EFFICIENCY OF RABBITEYE BLUEBERRIES,
Tuskegee Inst., AL. Dept. of Agricultural Sciences.
For primary bibliographic entry see Field 3D.
W86-02433

EVALUATION OF DRAINAGE TILE TO ALLEVIATE SALT BUILDING IN HEAVY SOILS IRRIGATED WITH BRACKISH WATER AND CROPPED WITH RICE AND SOYBEANS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
T. C. Keisling, J. T. Gilmour, H. D. Scott, A. M. Sadeghi, and R. E. Baser.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211795, Price codes: A03 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project Completion Report, Publication No. 111, August, 1984, 31 p, 4 tab, 6 fig. USGS G-829-07.

Descriptors: *Tile drainage, *Saline soils, *Drainage, Salinity, Mathematical models, Rice, Soybeans, Arkansas, Irrigation.

The use of tile drains for alleviating soluble salt accumulation on silt loam soil was investigated during 1984. Although the chemical analyses of the floodwater and tile drainage water were very similar, suggesting that floodwater was moving to the tile drain, the overall results so far indicate that this is not a feasible solution owing to lack of significant drainage. Application of DRAINMOD utilizing soil and weather data from Arkansas showed no significant effluent from the tile drains for our experimental site during rice production. This was attributed to the extremely slow saturated hydraulic conductivity values for this particular soil. However, more observations (concerning the operation of the tile field) are needed before it can be concluded that tile drain fields are not a viable solution to the problem.
W86-02450

ECOPHYSIOLOGICAL BASIS OF SALT TOLERANCE IN DISTICHLIS SPICATA: BACKGROUND FOR DOMESTICATION,
New Mexico State Univ., Las Cruces. Dept. of Biology.
G. L. Cunningham, P. R. Kemp, E. B. Allen, A. M. Cromer, and J. F. Reynolds.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215010/AS, Price codes: A06 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Report No. 175, Las Cruces, March 1983, 100 p, 18 fig, 24 tab, 84 ref. OWRT B-063-NMEX(1). 14-34-0001-0273.

Descriptors: Photosynthysis, *Salinity, *Grasses, Temperature, Sodium Chloride, Growth, Biomass, *New Mexico.

Ditichilis spicata is a highly productive salt-tolerant grass species with considerable potential for domestication as a forage crop on saline soils. It is broadly distributed throughout North America in a variety of coastal and inland habitats. Effective efforts to domesticate D. spicata will require an ability to predict its primary production under a range of environmental and cultural practices to which it might be subjected. Ecotypic differences among populations from contrasting environments might make it necessary to match the physiological adaptations selected in particular natural environments with the environments and culture conditions under which it might be grown. Two coastal and two inland populations were evaluated for differential response to salinity level and temperature. Ecotypic variations with regard to growth, photosynthetic ability, biomass allocation and leaf chemical composition were found. Populations were also found to differ in their responses to the principal anion in the growth substrate. Modeling of photosynthetic response to growth salinity, temperature and light revealed the manner in which these variables influence productive capacity. Studies of the influence of mycorrhizae on growth and physiological function indicated that they are not essential to the ability of D. spicata to tolerate salinity.
W86-02504

TREATMENT METHODS FOR REUSE OF MUNICIPAL SEWAGE EFFLUENT FOR MINERAL FLOTATION IN THE MINING INDUSTRY,
Arizona Univ., Tucson. Dept. of Civil Engineering.
P. H. King, G. L. Amy, G. Chandler, T. L. Young, and G. E. Cronk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227221/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical completion report, Arizona Water Resources Research Center, Tucson, December 1984. 52 p, 8 fig, 13 tab, 2 append. C-10138-R. 14-34-0001-1473 (1).

Descriptors: *Arizona, *Wastewater treatment, *Water reuse, Tertiary treatment, *Mineral flotation, Industrial use.

Efficient reuse of treated effluent from municipal wastewater systems is a key to effective water quality management in the arid southwestern United States. One potentially beneficial reuse target is the copper mining industry of southern Arizona. However, previous studies have indicated that some relatively undefined organic constituents of municipal sewage effluent are detrimental to copper and molybdenum recoveries in the froth flotation process. This process recovers minerals from ores and separates them into their respective fractions. This research was aimed at evaluating the feasibility of conventional secondary and selected tertiary treatment processes in removing organics from effluent. The effect of each treatment process on copper and molybdenum recovery was observed, first using single-cycle laboratory scale flotation tests, and then seventeen locked-cycle tests in which recycling of process water was inherent in the system. Three ore batches, eight secondary effluent samples, and five tertiary treatment schemes were investigated in the single-cycle test, and results were compared with those obtained using groundwater and projected Colorado River water. In addition, four model organic compounds were analyzed to determine the nature of those materials which present particular problems

in mineral recovery. In the locked-cycle tests, particular attention was given to the three most successful tertiary treatment processes, including foam fractionation, activated carbon adsorption, and ion exchange treatment. The results of the study demonstrate the technical feasibility of substituting tertiary-treatment wastewater for high quality groundwater. Activated carbon was the most successful tertiary process studied.
W86-02587

3D. Conservation In Domestic and Municipal Use

COMPARISON OF METABOLIC INHIBITORS, FILM-FORMING ANTITRANSPIRANTS, AND MICROJECT IRRIGATION FOR WATER USE EFFICIENCY OF RABBITEYE BLUEBERRIES,
Tuskegee Inst., AL. Dept. of Agricultural Sciences.
F. M. Basiouny.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-204006/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, December 1984. 62 p, 89 ref, 8 tab, 8 fig. 14-34-0001-0510.

Descriptors: *Abscisic acid, *Phenyl mercuric acetate, *Stomatal diffusive resistance, *Transpiration, *Relative humidity, *Fruit quality criteria.

Two metabolic inhibitors abscisic acid (ABA) and phenyl mercuric acetate (PMA), antitranspirant materials Clear Spray (CS) and Vapor Gard (VG), and microjet irrigation system were used on two rabbiteye blueberries cv. 'Tifblue' and 'Woodard'. The objective of this experiment was to study the effects of using the above materials in increasing yield, improving quality and water use efficiency of blueberry. Application of ABA, PMA, CS and VG, separately or in combination, with the microjet irrigation system significantly increased the water use efficiency of rabbiteye blueberries. The spray materials increased stomatal diffusive resistance, reduced transpiration and increased leaf temperature. Total soluble solids, pH, berry weight, volume, and yield were significantly increased.
W86-02433

DEVELOPMENT AND MANAGEMENT OF WATER FACILITIES FOR SMALL COMMUNITIES: PROCEEDINGS OF A CONFERENCE,
Virginia Water Resources Research Center, Blacksburg.
For primary bibliographic entry see Field 6B.
W86-02657

POLICY ANALYSIS OF RESERVOIR OPERATION, VOLUME I: EXECUTIVE SUMMARY; VOLUME II: COMPONENT STUDIES,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 6A.
W86-02730

3E. Conservation In Industry

INVESTIGATION OF POSSIBLE CYCLES OF CONCENTRATION IN INDUSTRIAL COOLING TOWERS USING VARIOUS COMBINATIONS OF TREATMENT PROCESSES TO RENOVATE MUNICIPAL WASTEWATER FEED,
Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 5D.
W86-02423

INDUSTRIAL WATER REUSE WITH COUPLED-TRANSPORT MEMBRANES,
Bend Research, Inc., OR.
For primary bibliographic entry see Field 5D.
W86-02425

3F. Conservation In Agriculture

DEVELOPMENT OF A PREDICTIVE IRRIGATION SCHEDULING INDEX USING ELECTROPHYTOGRAMS,
Arizona Univ., Tucson. Dept. of Electrical Engineering.
For primary bibliographic entry see Field 4A.
W86-02424

INCREASING ECONOMIC EFFICIENCY OF WATER USE FOR IRRIGATION IN THE UPPER MIDWEST,
Minnesota Univ., St. Paul. Water Resources Research Center.
R. R. Eidman, D. J. Bosch, E. E. Gill, and C. C. Shaeffer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-203958/AS, Price codes: A07 in paper copy, A01 in microfiche. Technical Completion Report, St. Paul, 1985, 121 p. OWRT B-158-Minn. 14-34-0001-1236.

Descriptors: *Irrigation water use, *Irrigation efficiency, *Minnesota, Economic aspects, Water use.

This study develops a more extensive methodology for evaluating irrigation strategies than previously existed. Near optimal strategies are identified given the level of soil water and weather information. The irrigation strategies are evaluated with reference to a benchmark strategy. The comparison is made within a whole-farm context considering the irrigator's risk performances, random ouput prices, and income taxes. Stochastic dominance with respect to a function is used to determine the value of the additional information and the related optimal irrigation strategy. Near optimal irrigation strategies were identified for alternative levels of information for corn and soybean production in southwestern Minnesota. The estimated value of perfect information on soil water and weather is $6.59 per acre for a risk neutral irrigator with low equity and 55 percent of that value can be obtained with currently recommended (but not widely used) programs of irrigation scheduling. The value is greater for risk averse and less for risk perferring irrigators. Adoption of near optimal strategies based on better information would also reduce average water use 13 to 17 percent. The methodology also has potential for use in evaluating the profitability of irrigation investments as illustrated in the study.
W86-02428

SPRINKLER IRRIGATION AS AN ENERGY AND WATER SAVING APPROACH TO RICE PRODUCTION AND MANAGEMENT OF RICELAND PESTS,
Texas Water Resources Inst., College Station.
G. N. McCauley, L. R. Hossner, and D. M. Nesmith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-203982/AS, Price codes: A11 in paper copy, A01 in microfiche. Technical Completion Report, TR-134, March 1985. 243 p, 149 tab, 16 fig, 5 append. USGS B-254-TEX(1). 14-34-0001-1282.

Descriptors: *Texas, Rice, Water, Energy, *Sprinkler irrigation, Texas Coastal Prairie, Water conservation, Cultivars, Flood irrigation.

Rice is currently produced on about 400,000 acres in the Texas Coastal Prairie and uses 1.8 million acre-feet of water or 13 percent of Texas' renewable water resources. The Texas Coastal Prairie has been experiencing rapid population and industrial growth with increased demands on the area water. Continued rice production will require water conservation practices. This research evaluated the potential water conservation of sprinkler irrigated rice production as related to potential production of commercial cultuvars with various moisture stress levels, the sprinkler irrigation adaptability of 10 major soil series, and increased infiltration by adjuvants. Some cultivars did exhibit resistance defined as sustained production under reduced water supply. However these cultivars were not the most productive. Highest yielding cultivars under flood irrigation were also the highest yielding with sprinkler irrigation. The medium grains appear better adapted. The adjuvants tested did increase the infiltration of the Nada soil. Yield levels within 15 percent of those from flood irigations were achieved. However, the high levels of adjuvants used were phytotixic to the rice. Lower rates or other adjuvants might be better adapted. Soil water infiltration as determined by rainfall simulator did reveal differences in infiltration rates of the soils tested. The clay soils had the highest saturated infiltration rate. The fine sandy loam soils developed a crust after initial applications which reduced later infiltration rates. All soils could be sprinkler irrigated but soils such as the Nada fine sandy loam had a saturated infiltration of less than 0.65 cm per hour which could be prohibitive to a commercial rice production.
W86-02431

LOW ENERGY IRRIGATION FOR THE PACIFIC NORTHWEST,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
T. S. Longley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211662/AS, Price codes: A05 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute Completion Report, Moscow, March, 1985. 63 p, 22 fig, 12 tab, 16 ref. B-056-IDA(1). 14-34-0001-1218.

Descriptors: *Irrigation efficiency, Energy, Irrigation, *Sprinkler irrigation, Drip irrigation, Trickle irrigation, *Idaho.

Basin tillage (surface storage enhancement by soil roughening) has been shown to be effective in controlling runoff from small grain plots irrigated with application rates up to 115 mm/hr and total applications up to 75 mm with a single line of low pressure spray sprinklers. A grain stand reduction problem encountered with the use of basin tillage was overcome with modification of the hanger arrangement on the double disc openers on the drill. After these modifications, basin tilled treatments of spring wheat produced stands and yields not significantly different from conventional tillage. Runoff measurements indicated that no runoff occurred using reservoir tillage, and from 10 to 60 percent of the water applied left the field with conventional tillage. Microclimate measurements were made 15, 27 and 40 m downwind of an operating low pressure sprinkler lateral on a number of different days with varying wind conditions. Marked decreases in vapor pressure deficit (VPD) were consistently observed at the 15 m position relative to conditions 9 m upwind of the system. This reduction in VPD resulted primarily from a reduction in dry bulb temperature. Windspeed did not appear to affect the magnitude and spatial distribution of these changes. Replicated evapotranspiration (ET) measurements were made on four crop species (alfalfa, dry beans, wheat and potatoes) which showed small but significant reductions in ET at the 15 m position for all species but dry beans, which showed a substantial decrease. For alfalfa, ET was significantly increased 27 and 40 m downwind of the system.
W86-02437

DESIGN AND MANAGEMENT OF IRRIGATION PROJECTS FOR THE SUSTAINED BENEFIT OF WILDLIFE: A BIOECONOMIC ANALYSIS OF THE EAST HIGH AREA OF THE COLUMBIA BASIN PROJECT,
Washington State Univ., Pullman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6G.
W86-02440

IDENTIFICATION OF CRITICAL WATER LEVELS IN FLOODED RICE FIELDS,
Arkansas Univ., Fayetteville. Dept. of Agricultural Engineering.
C. L. Griffis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211753/

AS, Price codes: A03 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project completion Report, Pub. No. 107, Sept. 1984. 22 p, 1 fig. USGS G-829-02.

Descriptors: *Mathematical models, Irrigation, Rice, Microcomputer, *Arkansas.

A mathematical model was developed to simulate the transient hydrology of a flooded rice field. With the model, users can determine the critical interlevee areas in which to monitor the water levels so that the irrigation well can be turned on at the critical low water level, and turned off at the critical high water level, in order to maximize water application efficiency. Sensitivity analysis performed with the model showed that it will be necessary to calibrate the model for each specific field. A calibration procedure has been developed.
W86-02446

WATER AND ENERGY CONSERVATION THROUGH IRRIGATION SCHEDULING,
Michigan State Univ., East Lansing. Dept. of Agricultural Engineering.
V. F. Bralts, and T. L. Loudon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214567/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, Michigan Institute of Water Research, 29 p, 5 fig, 41 ref, East Lansing, Sept (1984). USGS G849-05.

Descriptors: *Michigan, *Irrigation scheduling, Crop coefficients, Sprinkler irrigation, Water use efficiency, Evapotranspiration.

Over the past five years, irrigated areas have increased substantially in Michigan and in other midwestern states. Existing water balance models used for irrigation scheduling have been largely developed for application in the arid to semi-arid west. The procedures in these models for estimating evapotranspiration (ET) using crop coefficients, effective rainfall and deep percolation estimates were inadequate for application to areas with significant growing season rainfall. The overall goal of this research was to develop improved methods for scheduling the timing and amount of water used for irrigation in the more humid areas to the midwest. To address the need for improved crop coefficients a technique for using a portable chamber to measure actual ET in the field was developed and compared to ET measured by a weighing lysimeter. In addition an interactive microcomputer program was developed which includes historic rainfall probabilities in irrigation scheduling forecasts. The results of this research should serve as a basis for the future development of local crop coefficients and the further development of improved irrigation scheduling techniques for field crops in Michigan and other midwestern states where supplemental irrigation is practiced.
W86-02460

ADAPTING THE WATER MANAGEMENT SIMULATION MODEL DRAINMOD FOR THE GREAT LAKES REGION,
Michigan State Univ., East Lansing. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W86-02483

ECOPHYSIOLOGICAL BASIS OF SALT TOLERANCE IN DISTICHLIS SPICATA: BACKGROUND FOR DOMESTICATION,
New Mexico State Univ., Las Cruces. Dept. of Biology.
For primary bibliographic entry see Field 3C.
W86-02504

OPTIMIZATION OF IRRIGATION TECHNIQUES TO REDUCE WATER NEEDS FOR FIELDS WITH IRREGULAR BOUNDARIES,
Auburn Univ., AL. Dept. of Agricultural Engineering.
E. W. Rochester.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-219046/AS, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, Alabama Water Resources Research Institute, Auburn, September 1984. 65 p, 28 fig, 3 tab, 26 ref, 1 append. USGS G880-04.

Descriptors: *Sprinkler irrigation, *Alabama, *Irrigation efficiency, *Boundaries, *Linear programming, Optimization, Water conservation, Water use, Water distribution, Irrigation, Water management, Water use efficiency, Simulation analysis, Irrigation water, Computer models, *Mathematical models.

A technique was developed to optimally position center-pivot irrigation systems in fields with irregular boundaries. The technique utilizes a discrete approximation of the field and boundaries by utilizing a matrix of points for the evaluation of water application. The matrix of points encompasses the field and boundaries and includes surrounding points. An accounting technique is utilized to determine application uniformity and distribution. Two strategies were utilized for the optimum positioning of center-pivot irrigation systems. In strategy 1, the maximum number of center-pivot irrigation systems is placed inside a field boundary with the restriction that there be no overlap or water applied outside the field boundary. Strategy 2 was to minimize deviations from one application. Bivariate linear programming was used as the optimization technique.
W86-02551

ECONOMIC APPROACH TO THE ESTIMATION OF A DYNAMIC PRODUCTION FUNCTION FOR AN IRRIGATED CROP,
California Univ., Davis. Dept. of Agricultural Economics.
J. M. Antle, and S. A. Hatchett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225936/AS, Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center, Davis Completion Report, Sept. 1984, 28 p, 3 tab, 22 ref. USGS G830-05.

Descriptors: *Economic aspects, *Crop production, Irrigation, Model studies, Statistical models, Wheat, *Irrigation efficiency.

The objectives of the research was to develop an economic model of irrigated crop production which incorporates the dynamic response of the crop to water and the farmer's irrigation decision-making process over time. An appropriate statistical model is developed to estimate the parameters of the response (production) function. The model and methodology are applied to the case of irrigated wheat production in the Imperial Valley of California. The estimated model shows that water productivity changes substantially in the growing stages. The implications for optimal water use are therefore substantially different than those of a static response model. (Snyder-California)
W86-02569

IMPLICATIONS FOR TOTAL WATER DEMAND FROM THE ADOPTION OF DRIP IRRIGATION IN WESTERN AGRICULTURE,
California Univ., Santa Barbara. Dept. of Economics.
M. F. Caswell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225951/AS, Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center, Davis Completion Report, Sept. 1984. 40 p, 8 tab, 52 ref. USGS G830-04.

Descriptors: *Water demand, *Drip irrigation, *Trickle irrigation, *Mist irrigation, *Irrigation practices, *Water costs, Water conservation, Potential water supply, *California.

Data gathered on irrigation technology choices for the major perennial crops grown in six counties of the Central Valley of California were analyzed to study the effect of the adoption of low-volume irrigation systems on agricultural water demand. The probabilities of adoption for both sprinkler and drip irrigation technologies were estimated as a function of water costs, regional differences, water sources, and crop characteristics. The results were used to simulate the effects of water price increases on the relative share of each irrigation technology and the average water use per acre. The final stage of the analysis was to calculate the aggregate water demand for fruit and nut crops in each of the six counties. This demand was determined for current water costs in each area and then for price increases of $20 and $50 an acre-foot. Study results show that for perennial crops alone, almost 200,000 acre-feet of water would be saved if there were a $50 an acre-foot increase in the price of water. (Snyder-California).
W86-02571

SCHEDULING IRRIGATION WITH A HIGH SPEED CENTER PIVOT TO REDUCE HEAT AND MOISTURE STRESS IN CORN,
Nebraska Univ.-Lincoln. Center for Agricultural Meteorology and Climatology.
B. L. Blad.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227270/AS, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, Nebraska Water Resources Center, Lincoln, September 1984. 15 p, 4 tab, 5 ref. USGS G854-07. 14-08-0001-G854.

Descriptors: Water conservation, *Irrigation effects, *Irrigation practices, *Moisture stress, Air temperature, *Crop response, Heat balance, Humidity, Nebraska, *Irrigation scheduling, *Center pivot irrigation.

Sprinkler irrigation reduces air temperature and increases relative humidity by evaporative cooling in and above the canopy. Experiments needs to be conducted to observe if these effects are beneficial to plants, especially during periods of heat and moisture stress caused by high temperatures. Reduction of actual plant temperature, distribution of water on plant, and amount of water present also need to be investigated. Research began in 1983 near Grant, NE with Pioneer 3727 corn. Atmospheric data were measured with instruments located on opposite sides of a 120-acre field and data were stored on cassettes by a data micrologger. The field was irrigated by a high-speed center pivot; tests applied 1 mm of water over a 10-minute period. Plant temperatures were measured by a copper-constantan thermocouple inserted into the growing point of the corn plant. Canopy air temperatures decreased 3-5 degrees C and relative humidities increased 12-15% for 30-45 minutes; above canopy air temperatures lowered 1-2 degrees C, and relative humidities raised 6-10%. Variable plant temperatures and a concern for water distribution warranted further studies near Tryon, NE in 1984. Data were collected in similar fashion; however, irrigation was applied with a solid set irrigation system at a rate equal to the center pivot. Improved plant thermocouples showed expected plant temperatures without irrigations. Extension of this research is planned and suggested based on applications to water resource problems.
W86-02592

MAXIMIZING WATER USE EFFICIENCY OF LIMITED IRRIGATION PLUS NATURAL PRECIPITATION USING CONSERVATION CROPPING SYSTEMS,
Nebraska Univ., North Platte. Dept. of Agronomy.
G. W. Hergert, N. L. Klocke, G. A. Wicks, P. T. Nordquist, and P. H. Grabouski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227288/AS, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, Nebraska Water Resources Center, Lincoln, September 1984. 7 p, 3 tab. USGS G854-09. 14-08-0001-G854.

Descriptors: *Water utilization, *Nebraska, *Irrigation efficiency, Conservation, Groundwater, *Crop rotations, Crop production, Effective precipitation, Cultivation, Soil erosion, No-till farming.

The overall objective of this project was to determine the production potential of corn, wheat and soybeans which received no irrigation, limited irrigation (6 inches) and full irrigation in a residue management/no-till farming system. Specific objectives were: (1) to determine the yield potential of grain cropping systems by maximizing storage of natural precipitation and increasing the water use efficiency from limited irrigation; (2) to develop technologies to improve cultural practices that may be needed to adopt these cropping systems; and (3) to estimate the economic impact for producers who shift from fully-irrigated systems to proposed limited irrigation systems. Five crop rotations using the three crops in each of the three moisture regimes were compared. Because of limited time, the 1984 crops have not been harvested. Preliminary data from the dryland and limited irrigation blocks for 1982 and 1983 show: (1) soil moisture conserved by this no-till system may be sufficient to sustain continuous dryland farming in this area; (2) timely application of 6" of water to the rotations gave yield increases above dryland of 20 bushel wheat/A, 50 bushels of corn/A and 30 bushels of soybeans/A; (3) commercially available planters for corn and soybeans can be modified to work well in this system; and (4) crop rotations can reduce some disease problems and decrease reliance on chemicals.
W86-02593

ASSESSMENT OF THE EFFECTIVENESS OF TECHNOLOGY TRANSFER METHODS LEADING TO THE ADOPTION OF A NEW IRRIGATION DESIGN,
Texas Water Resources Inst., College Station.
L. E. Ruesink.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232767/AS, Price codes: A03 in paper copy, A01 in microfiche. Research Project Completion Report, July, 1984. 38 p, 8 tab, 2 fig, 2 append, 20 ref. USGS G-871-22. 14-08-0001-G-871.

Descriptors: *Technology transfer, Effectiveness, *Irrigation design, Evaluation.

Texas irrigators have been hard hit by soaring energy costs and declining groundwater in recent years. To survive, they must find ways to reduce energy and water demands in their operations. A new concept in irrigation design now available to Texas irrigators has the potential of significant savings in both water and energy requirements. The system, labeled the Low Energy Precision Application (LEPA) System, distributes water directly to the furrow at very low pressure through drop tubes from an overhead frame. A survey of change agents such as county agricultural agents; local, state, and federal irrigation specialists; and irrigation equipment deals and company representatives helped compile as complete a list as possible of irrigators who used the new irrigation method in 1983. Change agents also identified channels through which information on the technology had been disseminated. The most effective methods of technology transfer, according to a survey of irrigators who have adopted some form of the concept, are the research agency and farm publications as initial sources of information. Irrigators surveyed named irrigation equipment dealers and company representatives as the most important channel leading to adoption and the source they would most likely recommend to others interested in adoption. Identification and evaluation of the channels which convinced a widespread, independent group of irrigators to modify their conventional application methods should help future change agents develop more effective programs for technology transfer.
W86-02621

ANALYSIS OF THE ECONOMICS OF IRRIGATION PUMPING AND DISTRIBUTION EFFICIENCES IN NEVADA,
Nevada Univ., Reno. Dept. of Agricultural Economics.
T. R. Harris, M. K. Glover, and C. R. Ulrich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232791/AS, Price codes: A04 in paper copy, A01 in microfiche. Project Completion Report, Publication 43012, Nevada, Water Resources Research Center, Reno. 44 p, 15 fig, 9 tab, 22 ref. USGS G855-03. 14-08-0001-G-855.

Descriptors: *Nevada, Alfalfa, Irrigation, *Irrigation pump efficiency, Low pressure system, Existing irrigation system cost generator, Microcomputer, Accelerated cost recovery system, *Computer programs, *Irrigation cost efficiency, Economics.

Irrigated agriculture in Nevada is a major segment of the states' agricultural sector. However with increasing fuel costs, the efficient application of water is desired. Two methods of improved irrigation practice were investigated: increasing pumping plant efficiency and conversion of low pressure irrigation. To determine the costs of declining pumping plant efficiencies, a microcomputer program was developed which determined the amount of additional hours required to pump a given quantity of water or the decline in water applied for a constant hours available for pumping at lower pumping plant efficiency. The change in net returns for an alfalfa producer in Diamond Valley, Nevada, was derived for a 72%, 57%, and 48% efficient pumping plant. Also the costs of converting a high pressure irrigation system to a low pressure system were estimated. With the 1981 tax bill, the Accelerated Cost Recovery System was enacted which could effect investments in upgrading irrigation systems. Through an investment simulation model, it was found that an investment to upgrade a 48% efficient pumping plant to 72% efficiency was very profitable under the ACRS depreciation procedure where expensing was allowed.
W86-02624

ASSESSING WATER-SHORTAGE RISK OF RESERVOIRS BY STOCHASTIC SIMULATION,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 4D.
W86-02639

IMPACT OF IMPROVED AGRICULTURAL WATER USE EFFICIENCY ON RESERVOIR STORAGE IN SUB-HUMID AREAS,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
J. K. Koelliker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233039/AS, Price codes: A04 in paper copy, A01 in microfiche. Kansas Water Resources Research Institute Completion Report, Manhattan, 1984. 59 p, 12 tab, 11 fig, 21 ref, 5 append. USGS G843-02.

Descriptors: *Kansas, Water yield, Streamflow, Reservoirs, Soil conservation, *Water conservation, Agricultural runoff, Computer models, Simulation analysis, Water use efficiency.

Surface water yield from semiarid and subhumid regions of the Great Plains have been decreasing since the 1950s. Changes in agricultural technology on non-irrigated areas including practices which permanently retain water (ponds and level terraces) and increase infiltration (residue management) are the main factors. Development of irrigation from surface water supplies and withdrawals of groundwater from alluvial aquifers are also important. This work used methodology developed previously to estimate the effects of agricultural technology developments, particularly on non-irrigated areas, to reduce streamflow in a subhumid region. Current net reduction in the lower portion of the Republican River basin was estimated to be 15 percent of total potential streamflow and will increase to 22 percent by 2025. About 25 percent of the gross reduction in surface runoff from these areas is expected to subsequently become streamflow or to satisfy depletions of streamflow. Continued development of irrigation will be a greater factor in overall streamflow reduction in this area. Water supply capability of Milford Reservoir is declining and will continue to decline because of agricultural technology in its drainage basin. Currently, the sustainable draft capacity is estimated to be about 75 percent of its original design capacity. By 2000 and 2025 it is expected to decrease to 60 and 50 percent, respectively, of the original design capacity.
W86-02648

METHODOLOGY TO INCREASE PRECISION IN MEASUREMENT OF IRRIGATION EFFICIENCY,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 6D.
W86-02649

FEASIBILITY OF SUBIRRIGATION SYSTEMS ON CLAYPAN SOILS IN THE MIDWEST,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4B.
W86-02697

EVALUATION OF 0.1 N NAHCO3 EXTRACTION FOR DETERMINATION OF AVAILABLE NITROGEN,
Delaware Univ., Newark. Dept. of Plant Science.
For primary bibliographic entry see Field 2G.
W86-02703

IRRIGATION SCHEDULING PROCEDURES WITH LIMITED WATER FOR IMPROVED WATER USE EFFICIENCY FOR CORN AND SOYBEANS, 1982-1984 STUDIES,
Nebraska Univ.-Lincoln. Dept. of Agricultural Engineering.
G. E. Meyer, P. E. Fischback, and J. A. Lamb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-126174/AS, Price codes: A09 in paper copy, A01 in microfiche. Final Report, June 1985. 172 p, 26 fig, 23 tab, 95 ref, 6 append. C-90281-C. 14-34-0001-1465.

Descriptors: *Irrigation requirements, Irrigation efficiency, Computer models, *Simulation analysis, Crop yields, Corn, Soybeans, Nebraska.

A 3-year irrigation scheduling study using computer control, computer simulation, field and growth chamber studies was conducted. Microprocessor hardware and software aided both field irrigation scheduling and growth chamber studies of corn and soybeans using simulated weather sequences to mimic field conditions. Corn yields of 11,000 Kg/ha (170 bu/ac) were grown with only 22 cm of supplemental irrigation during a dry summer of 1984 with frequent well-timed irrigation events on relatively poor-drained soils at Mead, Nebraska. Irrigation scheduling of field soybeans did not significantly improve yields (3,000 Kg/ha) in any of the years, although results in plant growth chambers indicated that soybeans are very sensitive to moisture stress. From simulation studies using physiological plant growth models, it was concluded that crop performance levels in the fields may be only at 30 to 40 percent of their physiological potential using current production systems.
W86-02727

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

DEVELOPMENT OF A PREDICTIVE IRRIGATION SCHEDULING INDEX USING ELECTROPHYTOGRAMS,
Arizona Univ., Tucson. Dept. of Electrical Engineering.
W. G. Gensler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-157832, Price codes: A02 in paper copy, A01 in microfiche.

Group 4A—Control Of Water On The Surface

Research Project Technical Completion Report, Arizona Water Resources Research Center, Tucson, September 1984, 12 p, 4 fig, 1 tab, 2 ref. USGS G828-05.

Descriptors: *Irrigation efficiency, *Instrumentation, Electrochemistry, Potentiometric level, Electrodes, *Irrigation scheduling, Plant growth, *Arizona, Telemetry.

An irrigation management instrument system was tested using electrochemical and biophysical sensors placed directly on the plant in the field. The sensors were calibrated at different water regimes in furrow and drip irrigated cotton. Plant water status was directly monitored with a probe in the plant. Stem diameter measurements used electromechanical transducers attached to plants. A telemetry system was developed to transfer the signal from the field to the grower's headquarters. These methods can probably be adapted for field use in irrigation management.
W86-02424

LOW ENERGY IRRIGATION FOR THE PACIFIC NORTHWEST,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W86-02437

PHYSICAL MODEL STUDIES TO VERIFY A NUMERICAL MODEL OF FLOOD ROUTING,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W86-02486

HYDRILLA MANAGEMENT IN NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W86-02507

QUANTITATIVE ASPECTS OF WATER RESOURCE MANAGEMENT,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
C. D. Morris, J. W. Hood, and J. A. Ferguson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-230092/AS, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, September 1984. 41 p, 2 tab, 7 fig, 11 ref, append, USGS G-852-03. 14-08-0001-G-852.

Descriptors: Hydrology, Stochastic, Modelling, Rainfall, Water resources, Water supply, Management, *Water resources management, *Rainfall-runoff relationships.

A stochastic model is developing to define a hydrologic extreme and describe the likelihood of occurrence of various drought situations. The purpose of the study is to define drought probabilities so management strategies may be developed to minimize the impact to the study area of Springfield, Missouri, or generally in the State of Missouri. Daily rainfall data were obtained for the study area and a time series analysis was performed to evaluate the temporal structure of the data. From this, a stochastic model is developed that enables researchers to synthesize up to 500 years of daily rainfall data. The Water Supply Model currently used for planning is reviewed and altered for comparison with runoff models developed specifically for this application. One model uses multiple linear regression to predict low flow on the James River. Water supply reservoir inflows are calculated using the Soil Conservation Service curve number approach to estimate lake inflow volumes from stochastically generated rainfall values. Finally, conclusions are drawn relative to the adequacy of Springfield's water supply and to the relevance of this technique to other study areas.
W86-02617

ANALYSIS OF THE WATER BALANCE OF B. EVERETT JORDAN LAKE INCLUDING ESTIMATES OF FLOWS BETWEEN SEGMENTS,
North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249076/AS, Price codes: A03 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Completion Report No. 221, April, 1985. 26 p, 10 fig, 4 tab, 3 ref.

Descriptors: *Storage capacity, *Stream discharge, *Reservoir stages, Flow, Reservoir releases, Reservoir yield, B. Everett Jordan Reservoir, *North Carolina.

B. Everett Jordan Lake, a recently completed multipurpose reservoir located in the north central Piedmont of North Carolina, has a unique hydrologic structure that makes prediction of internal flows within the reservoir especially difficult. This report contains estimates of these flows for the period October 1, 1982, to September 30, 1983. Estimates are based on mass balance equations for each of the four segments within the lake. A comparative analysis of daily, monthly, and annual storage changes as calculated from deviation changes and mass balances for the lake as a whole indicates that errors are within the limits of accuracy reported for stream flows.
W86-02686

POLICY ANALYSIS OF RESERVOIR OPERATION, VOLUME I: EXECUTIVE SUMMARY; VOLUME II: COMPONENT STUDIES,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 6A.
W86-02730

TECHNIQUES FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS ON STREAMS IN INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02780

METHOD FOR ESTIMATING MEAN AND LOW FLOWS OF STREAMS IN NATIONAL FORESTS IN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02824

AVAILABILTY OF NATURAL AND REGULATED STREAMFLOWS FOR INSTREAM USES DURING HISTORICAL DROUGHTS, LOWER NEOSHO RIVER, SOUTHEASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02838

SPIRIT LAKE DAM-FAILURE FLOOD ROUTING ASSESSMENT,
Geological Survey, Tacoma, WA. Water Resources Div.
D. L. Kresch.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 82-770, 1985. 8 p, 2 tab, 1 ref.

Descriptors: *Flood routing, *Dam failure, *Washington, Spirit Lake, *Mount St. Helens, Streamflow, Floods, Peak discharge.

Potential clear-water floodflows resulting from uncontrolled breaching by Spirit Lake of a debris dam deposited by the May 18, 1980, eruption of Mount St. Helens, Washington, were evaluated. U.S. Geological Survey dam-break model K-634 was utilized, first to compute clear-water flood hydrographs for various hypothetical breach scenarios, and then to hydraulically route them downstream to the mouth of the Toutle River. Dam-break computations were obtained for 12 breach-development scenarios. Eight of the scenarios modeled breaches caused by overtopping of the June 1982 crest of the debris dam, while the other four modeled breaches resulting from overtopping of the debris dam at a possible future crest altitude of 3,490 feet. Equal numbers of scenarios, six each, were modeled for breach development durations of 0.25 hour and 1.0 hour. Peak discharges and times of arrival at selected locations for scenarios with breach development durations of 1.0 hour are presented in tables. Peak discharges computed for dam-break scenarios with breach crest widths of 400 feet are almost twice the magnitude of those computed for scenarios identical in all other respects, but with widths of 200 feet. Peak discharges computed for breaches caused by overtopping of the debris dam at an altitude of 3,531.8 feet were generally found to be roughly five times greater than those caused by overtopping at an altitude of 3,490 feet, if the breaches had identical crest elevations and crest widths. Decreases in peak discharge from Spirit Lake to the mouth of the Toutle River ranged from 16 to 26 percent for the scenarios modeled. This lack of significant attenuation is primarily due to the large volume and surface area of Spirit lake (in excess of 360,000 acre-feet and 3,000 acres, respectively, for all scenarios modeled), which result in the continued discharge of high flows long after breach development is complete. The degree of attenuation is also minimized by the generally steep narrow valleys through which the North Fork Toutle and Toutle Rivers flow. Elapsed time from beginning of breach development to arrival of peak discharges at the mouth of the Toutle River ranged from 4.3 to 7.4 hours for the scenarios modeled. (USGS)
W86-02846

MAGNITUDE AND FREQUENCY OF FLOODS IN ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02857

STREAM CHANNEL RESPONSE TO THE JANUARY 3-5, 1982 STORM IN THE SANTA CRUZ MOUNTAINS, WEST CENTRAL CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-02858

ESTIMATION OF THE FLOW AND WATER-QUALITY CHARACTERISTICS OF ALASKAN STREAMS,
Geological Survey, Fairbanks, AK. Water Resources Div.
B. Parks, and R. J. Madison.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4247, 1985. 64 p, 21 fig, 14 tabs, 69 ref.

Descriptors: *Streamflow forecasting, *Water yield, Regional analysis, Planning, Statistical methods, Hydrologic data, Forecasting, *Alaska.

Although hydrologic data are either sparse or nonexistent for large areas of Alaska, the drainage area, area of lakes, glacier and forest cover, and average precipitation in a hydrologic basin of interest can be measured or estimated from existing maps. Application of multiple linear regression techniques indicates that statistically significant correlations exist between properties of basins determined from maps and measured streamflow characteristics. This suggests that corresponding characteristics of ungaged basins can be estimated. Streamflow frequency characteristics can be estimated from regional equations developed for southeast, south-central and Yukon regions. Statewide or modified regional equations must be used, however, for the southwest, northwest, and Arctic Slope regions where there is a paucity of data. Equations developed from basin characteristics are given to estimate suspended-sediment values for

glacial streams and, with less reliability, for nonglacial streams. Equations developed from available specific conductance data are given to estimate concentrations of major dissolved inorganic constituents. Suggestions are made for expanding the existing data base and thus improving the ability to estimate hydrologic characteristics for Alaskan streams. (USGS)
W86-02864

BASE-FLOW CHARACTERISTICS OF SEGMENTS OF THE PINEY RIVER, AND EAST AND WEST PINEY RIVERS, DICKSON AND HICKMAN COUNTIES, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02910

4B. Groundwater Management

DISCHARGE AND TRAVEL TIME DETERMINATIONS IN THE ROYAL SPRING GROUNDWATER BASIN, KENTUCKY,
Kentucky Water Resources Research Inst., Lexington.
For primary bibliographic entry see Field 2F.
W86-02479

MATHEMATICAL MODELS FOR WATER RESOURCES POLICY AND MANAGEMENT WITH APPLICATION TO THE EUTAW-MCSHAN AQUIFER,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W86-02494

CLARIFICATION OF SURFACE WATERS FOR RECHARGE THROUGH WELLS,
California Univ., Davis. Dept. of Civil Engineering.
R. B. Krone, and R. W. Walls.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225910/AS, Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center, Davis Completion Report, Sept. 1984, 25 p, 10 fig, 2 tab, 15 ref. USGS G830-02.

Descriptors: *Clarification, Clogging, *Recharge wells, *Groundwater recharge, Wells, Artificial recharge, Disposal wells.

Clogging of the well face is a major impediment to artificial recharge of confined aquifers through wells. It appears that continuous recharge requires particle-free water. The use of surface waters for such recharge, therefore, requires treatment to remove suspended material. This report describes an investigation of the novel aggregation and sedimentation process that promised to provide low cost removal of particles. Extensive testing to evaluate velocity gradients and overflow rates, using suspensions of montmorillonite and kaolipite clays, showed that changing velocity gradients over the range of 4 to 16 sec-1 had a small effect with the optimum near 8 sec-1. Increasing the overflow rate above .036 cm/sec reduced the effectiveness of the sedimentation stage. At optimum conditions the effluent concentration of montmorillonite was 7 to 14 mg/1 and the concentration of kaolinite was 20 to 30 mg/1. The aggregation and sedimentation process does not produce an effluent that is suitable for recharge through wells. A fine sand pressure filter would be required to polish the effluent before injection. (Snyder-California)
W86-02567

RECOVERY OF WATER FROM THE UNSATURATED ZONE BY AIR INJECTION: I-DESIGN OF A LARGE PHYSICAL MODEL,
Texas Water Resources Inst., College Station.
D. L. Reddell, J. L. Nieber, G. Felton, and G. Moridis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232957/AS, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, August, 1984. 84 p, 3 tab, 16 fig, 11 ref. USGS G-871-02. 14-08-0001-G-871.

Descriptors: *Water yield improvement, Soil water, *Secondary recovery, Ogallala aquifer, Unsaturated zone.

'Secondary recovery' techniques (the injection of a second fluid such as natural gas or water into a reservoir under pressure) enhance oil recovery from reservoirs. Recently, air was injected into the unsaturated region above the Ogallala aquifer, and water levels in the area were raised significantly. Models describing this phenomena are needed for predictive purposes. Objectives of this research were to design a large physical model to verify numerical models, and explore similitude criteria for physical models of air-water flow in porous media. Precise similitude criteria were too restrictive; making the cost of a physical model prohibitive. Thus, a sand tank of a radial sector well 24 ft. long and 12 ft. high was designed to withstand air pressures of 100 psi. No attempt to meet the required similitude criteria was made. A two-phase oil and water numerical model from the petroleum industry was modified for air and water, and run using relative permeability vs. saturation data for sandstones from the petroleum literature. The volume of water below the water table was increased by 8% when air was injected. However, very accurate relative permeability vs. saturation data are needed for unconsolidated aquifers such as the Ogallala to obtain accurate results from the model. A permeameter to collect these data was designed and constructed; but no data were collected. A Phase II project is needed to construct the sand tank, collect permeability vs. saturation data, and make additional runs with the numerical model.
W86-02640

FEASIBILITY OF ARTIFICIAL RECHARGE TO THE HIGH PLAINS AQUIFER, NORTHWESTERN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Geology.
H. White, and W. Pettyjohn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249050/AS, Price codes: A05 in paper copy, A01 in microfiche. Oklahoma Water Research Institute, Technical Completion Report, Stillwater, 1985. 88 p, 25 fig, 3 tab, 88 ref. USGS G863-04. 14-08-001-G-863.

Descriptors: *Oklahoma, *Artificial recharge, High Plains aquifer, Ground water management, Irrigation, Water supply.

The purpose of this investigation was to evaluate the potential for artificial recharge to the High Plains-Ogallala aquifer in northwestern Oklahoma. The aquifer, which extends from South Dakota to Texas, is the principal source of water supply in the Oklahoma Panhandle as well as much of the High Plains. Precipitation in northwestern Oklahoma averages about 18 inches annually as does evapotranspiration. Runoff ranges from less than 0.2 inch to nearly 0.5 inch. The effective regional ground-water recharge rate is estimated to be less than 0.2 inch per year. Despite the semi-arid climate, northwestern Oklahoma supports the most extensive agricultural activities in the State due to extensive irrigation with ground water. Irrigation since 1940, and particularly since 1960, has caused water level declines that locally exceed 150 feet. Continued agricultural prosperity in the region depends on a reduction, or halt, in the rate of water level decline. Artificial recharge, where feasible, presents a means to augment the volume of water in storage and prolong the economic life of the aquifer. While artificial recharge may be viable and beneficial on a local scale, lack of a suitably large source of recharge supply restricts application on a regional scale.
W86-02684

HYDROLOGIC AND LEGAL ASSESSMENT OF GROUND WATER MANAGEMENT ALTERNATIVES FOR IDAHO,
Idaho Univ., Moscow. Coll. of Mines and Earth Resources.
D. R. Ralston, R. R. Broadhead, and D. L. Grant.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249084/AS, Price codes: A08 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, Moscow, Completion Report, May, 1984. 159 p, 1 fig, 10 tab, 42 ref. USGS G839-05. 14-08-0001-G839.

Descriptors: Groundwater management, Water law, Appropriation, *Conjunctive management, *Idaho, Snake River Basin.

A hydrologic and legal assessment was made of conjunctive management of surface and ground water resources of the upper Snake River Basin in Idaho. The report contains a hydrologic management classification of basins tributary to the upper Snake River and a legal examination of the uncertainties and complexities of conjunctive management of surface and ground water under the appropriation doctrine. Eleven basins tributary to the upper Snake River were selected for detailed study based upon existing data: Little Lost River, Big Lost River, Big Wood River-Silver Creek, Camas Prairia, Portneuf River, Michaud Flats, Rockland, Raft River, Rock Creek-Goose Creek, Salmon Falls Creek and Blue Gulch. The basins are classified based upon the following factors: (1) the ratio of annual basin discharge to total flow of the Snake River, (2) the ratio of annual consumptive pumpage to annual basin discharge, (3) the ratio of annual water yield to basin area, and (4) the distance that surface and ground water must flow before discharging into the Snake River. The legal uncertainties and complexities of conjunctive management examined include: (1) questions involving the magnitude and timing of the impact of junior tributary diversions upon supplies in the main source, both in private litigation between water users and in administrative regulation of water use: (2) selection of junior tributary diversions for closure when senior appropriators on the main source are not receiving their full supplies: (3) questions of burden of proof both in private litigation and in administrative regulation; and (4) the influence of policy objectives upon conjunctive management decisions. The study also focuses on a fundamental and difficult policy issue that may arise in a number of conjunctive management situations, namely, potential conflict between the policies of protecting senior vested rights and optimum development.
W86-02687

FEASIBILITY OF SUBIRRIGATION SYSTEMS ON CLAYPAN SOILS IN THE MIDWEST,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
S. Mostaghimi, W. D. Lembke, and C. W. Boast.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249183/AS, Price codes: A04 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana-Champaign, Research Report No 189, September 1984. 50 p, 15 fig, 3 tab, 33 ref. USGS G840-04. 14-08-0001-G840.

Descriptors: *Irrigation, *Drainage systems, *Illinois, *Claypan soils, Corn, Drain depth, Drain spacing, Dry days, Midwest, *Simulation model, Subirrigation, Subsurface drainage, Surface drainage, Trafficability, Water table depth, Weir depth.

This was a study to evaluate the suitability of subirrigation along with alternative soil and water management practices on claypan soil. Crop yields on these soils are usually low because of limited water management for crop production. Several years of crops, soil and weather data collected on a claypan soil in Illinois were used to study performance of subirrigation and conventional irrigation on these soils. Various drain spacings and depth combinations for both good and poor quality surface drainage were simulated. Results indicated that optimum drain spacing for subirrigation on these soils would be 6 m under good surface drainage, and a weir setting depth of 35cm on a 5-year

recurrence interval basis. However, such a close drain spacing may not be economically feasible.
W86-02697

WATER RESOURCES OF AURORA AND JERAULD COUNTIES, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
L. J. Hamilton.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4030, 1985. 58 p, 27 fig, 10 tab, 21 ref.

Descriptors: *Groundwater, *Aquifers, *Underground storage, Recharge, Drawdown, Aquifer characteristics, Water quality, Streamflow, Aurora and Jerauld Counties, *South Dakota.

Large quantities of slightly saline ground water are available for future water requirements in Aurora and Jerauld Counties, 1,236 square miles of glaciated, till-covered hills and plains in southeastern South Dakota. More than one million acre-feet of ground water is stored in five major glacial aquifers, outwash sand and gravel, beneath 340 square miles. About 58 million acre-feet is stored in bedrock, in the Niobrara marl aquifer, the Codell sandstone aquifer, and the Dakota sandstone aquifer. Recharge of aquifers by infiltration of precipitation totals 31,000 acre-feet annually. Effects of increased ground-water withdrawals generally have been small for glacial aquifers and large for some bedrock aquifers. Water levels declined 0.6 to 4 feet in glacial aquifers during 1978-80 within a mile of irrigation wells pumping 300 to 1,000 gallons per minute. In contrast, water levels declined 40 feet near a well pumping 1,500 gallons per minute from the Niobrara aquifer because of small artesian storage. Artesian pressure of the Dakota aquifer declined about 200 feet between 1909 and 1979 because of large withdrawals through flowing wells. The availability of surface water is limited because streams are ephemeral and have large flows only during spring of wet years. Most of the lakes are small, semipermanent, and shallow. Most surface water in the study area contains low concentrations of dissolved solids but most of the ground water is very hard and slightly saline. Some ground water has a very high-salinity hazard for irrigation. Water from the Niobrara and Codell aquifers also has a high sodium hazard and high boron concentrations. (USGS)
W86-02763

WATER-LEVEL DECLINES IN THE MAGOTHY AQUIFER IN SOUTHERN MARYLAND RELATED TO INCREASES IN PUMPAGE,
Maryland Dept. of Natural Resources, Annapolis.
For primary bibliographic entry see Field 2F.
W86-02781

ESTIMATING HIGHEST GROUND-WATER LEVELS FOR CONSTRUCTION AND LAND-USE PLANNING--A CAPE COD, MASSACHUSETTS, EXAMPLE,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02785

HYDROGEOLOGIC APPRAISAL OF A STRATIFIED-DRIFT AQUIFER NEAR SMYRNA, CHENANGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02793

EVALUATION OF THE HYDROLOGIC SYSTEM IN THE DICKINSON LIGNITE AREA, EASTERN SLOPE AND WESTERN STARK AND HETTINGER COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02796

ALTITUDE AND CONFIGURATION OF THE WATER TABLE IN THE HIGH PLAINS AQUIFER IN KANSAS, PRE-1950,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02807

HYDROGEOLOGIC SETTING AND THE POTENTIOMETRIC SURFACES OF REGIONAL AQUIFERS IN THE HOLLANDALE EMBAYMENT, SOUTHEASTERN MINNESOTA, 1970-80,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02809

AQUIFEM-SALT: A FINITE ELEMENT MODEL FOR AQUIFERS CONTAINING A SEAWATER INTERFACE,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02822

HYDROLOGY OF THE TERTIARY-CRETACEOUS AQUIFER SYSTEM IN THE VICINITY OF FORT RUCKER AVIATION CENTER, ALABAMA,
Geological Survey, Montgomery, AL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02825

GEOHYDROLOGY OF TEST WELL USW, H-3, YUCCA MOUNTAIN, NYE COUNTY, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02830

PRELIMINARY ASSESSMENT OF GROUND-WATER RESOURCES OF LAUDERDALE COUNTY, TENNESSEE,
Geological Survey, Memphis, TN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02833

INVESTIGATION OF GROUND-WATER RECHARGE BY INJECTION IN THE PALO ALTO BAYLANDS, CALIFORNIA--HYDRAULIC AND CHEMICAL INTERACTIONS, FINAL REPORT,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5D.
W86-02837

GROUND WATER IN UTAH'S RAPIDLY GROWING WASATCH FRONT AREA--THE CHALLENGE AND THE CHOICES,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02843

GROUND-WATER RESOURCES OF NORTHERN UTAH VALLEY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
D. W. Clark, and C. L. Appel.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report, State of Utah Dept. of Natural Resources Technical Pub. 80, 1985. 115 p, 48 fig, 23 tab, 39 ref.

Descriptors: *Groundwater, *Recharge, *Groundwater movement, Discharge, *Utah, *Water quality, Hydraulic properties, Subsurface flow, Artesian wells, Irrigation hydrographs, Canal seepage, Potentiometric level, Utah County, Urban areas, Utah Valley.

An evaluation was made of the ground-water resources of northern Utah Valley, Utah, to describe the ground-water system and to document changes in ground-water conditions since 1963. The principal ground-water reservoir is in basin-fill deposits. It consists of three major confined aquifers and an unconfined aquifer in pre-Lake Bonneville, which are a lateral extension of an unconfined aquifer deposits along the mountains that adjoin the valley. The principal ground-water reservoir contains about 3.5 million acre-feet of recoverable water. The surface-water inflow in major streams to the valley is a principal source of ground-water recharge. This inflow averaged approximately 390,000 acre-feet per year during water years 1963-82. The total annual ground-water recharge is estimated to average about 200,000 acre-feet. It includes about 73,000 acre-feet of seepage from waterways and 112,000 acre-feet of subsurface inflow from the consolidated rocks of the mountains. The total annual ground-water discharge is estimated to average about 220,000 acre-feet. It includes 135,000 acre-feet discharged to waterways and springs and 68,000 acre-feet withdrawn from wells. The annual ground-water withdrawal for public supply increased from about 5,000 acre-feet during 1963 to about 20,000 acre-feet during the late 1970's. This reflected an increase in urban population from about 72,000 in 1960 to about 164,000 in 1980. A reasonable estimate for both recharge and discharge to and from the principal ground-water reservoir is about 200,000 acre-feet per year. Water levels in wells fluctuate seasonally due to changes in rates of recharge or discharge, and the greatest changes are closest to points of recharge or discharge. Since 1970, water levels have declined, despite generally greater than average precipitation, due to increased withdrawal from wells for public supply. Ground water in the study area generally is suitable for most uses. There is little evidence of change in the chemical quality between the late 1950's and 1982. (USGS)
W86-02844

GROUND WATER HYDROLOGY OF THE ELIZABETHTOWN AREA, KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02845

PALEOZOIC ARTESIAN AQUIFERS IN THE TEN SLEEP AREA OF THE BIGHORN BASIN, NORTH-CENTRAL WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02847

USE OF A DIGITAL MODEL TO DETERMINE THE EFFECTS OF PROPOSED PUMPING FROM THE PRINCIPAL ARTESIAN AQUIFER, SAVANNAH, GEORGIA, AREA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02851

HYDROLOGY OF THE SOUTHERN PARTS OF OKALOOSA AND WALTON COUNTIES, NORTHWEST FLORIDA, WITH SPECIAL EMPHASIS ON UPPER LIMESTONE OF THE FLORIDAN AQUIFER,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02853

AVAILABILITY AND QUALITY OF WATER FROM THE BEDROCK AQUIFERS IN THE RAPID CITY AREA, SOUTH DAKOTA,
Geological Survey, Rapid City, SD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02854

SIMULATION OF AN AQUIFER TEST ON THE TESUQUE PUEBLO GRANT, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02866

ANALYSIS OF THE CARMEL VALLEY ALLUVIAL GROUND-WATER BASIN, CALIFORNIA, USING DIGITAL FLOW MODEL TECHNIQUES,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02869

EFFECTS OF ARTIFICIAL RECHARGE ON THE BIG SIOUX AQUIFER IN MINNEHAHA COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
N. C. Koch.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4312, 1984. 8 p, 3 fig, 1 tab, 1 ref.

Descriptors: *Artificial recharge, *Computer models, *Aquifers, *Surface water-groundwater relationships, Minnehaha County, *South Dakota.

The Big Sioux aquifer in Minnehaha County is a water-table aquifer hydraulically connected to the Big Sioux River. A digital-computer model previously developed by the U.S. Geological Survey was used to simulate potential effects of artificial recharge on the aquifer. A simulation was made by recharging water at the rate of 870 gallons per minute for four 30-day periods. Total water recharged to the aquifer during the 120 days was 150.3 million gallons. About 24.4 million gallons of water discharged from the aquifer to the river during the 120-day recharge period and about 30 million gallons discharged from the aquifer to the river during three 30-day recovery periods, both as a result of the artificial recharge, therefore, a total of 54.4 million gallons or 36 percent of the 150.3 million gallons that was artificially recharged from the aquifer to the river. (USGS)
W86-02870

GROUND-WATER RESOURCES OF THE MATTAPOISETT RIVER AQUIFER, PLYMOUTH COUNTY, MASSACHUSETTS: SUMMARY FOR WATER-RESOURCE MANAGERS,
Geological Survey, Boston, MA. Water Resources Div.
V. de Lima, and J. C. Olimpio.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4023, 1984. 43 p, 17 fig, 5 tab, 22 ref.

Descriptors: *Glacial aquifers, *Groundwater models, *Wells, *Streamflow, *Water table, *Water level fluctuations, *Municipal pumping, Ground-water movement, Streambed infiltration, Hydrologic cycle, Basic hydrology, *Groundwater resources, Plymouth County, *Massachusetts, Simulation analysis, *Surface-groundwater relationships.

Proposed increases in municipal pumpage in the Mattapoisett River valley will triple ground-water withdrawals in the next two decades. Because of State and local concern about the long-term effects of these withdrawals on ground-water levels and streamflow, a digital ground-water-flow model was developed to assist water-resource management. Ten development scenarios representing existing and proposed withdrawals were simulated using drought conditions. Under conditions simulating 1965, the driest year of record, predicted water levels in the aquifer are as much as 9 feet lower than average. Under severely dry conditions, simulating only enough recharge to keep the river flowing with no pumping, the predicted water levels are as much as 19 feet lower than average. During the greatest pumping demands, the predicted drawdown in five wells could cause well failure. Simulated pumping demands in six scenarios use all available ground-water discharge. Under severely dry conditions, it is predicted that the downstream half of the river will stop flowing under most pumping plans. (USGS)
W86-02874

GROUND-WATER CONDITIONS AND SHALLOW TEST-WELL INFORMATION IN THE EASTERN HALF OF MERCED COUNTY, CALIFORNIA, 1977-82,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02876

EXAMPLE CALCULATIONS OF POSSIBLE GROUND-WATER INFLOW TO MINE PITS AT THE WEST DECKER, EAST DECKER, AND PROPOSED NORTH DECKER MINES, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. E. Davis.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4199, 1984. 31 p, 7 fig, 6 ref.

Descriptors: *Groundwater, *Influent seepage, *Strip mines, Mine drainage, Surface-groundwater relationships, Decker coal-mining area, *Montana, Tongue River Reservoir.

Proposed plans to raise the spillway of the Tongue River Dam, Montana, 14 feet would result in an increase in the reservoir stage, which will affect the amount of ground-water inflow from the reservoir to existing and proposed surface coal mine pits near Tongue River Reservoir. Example calculations are based on flow from the reservoir to the mine pits through areas approximately perpendicular to the long axis of the reservoir. The planned increase in the stage of the reservoir will result in an increase of inflow to the mine pits in most areas. The increases will be greatest where the mine pits are near the reservoir and separated from the reservoir solely by aquifer zones of relatively large hydraulic conductivity. However, the inflow determined from the calculations is subject to a large degree of error, owing to the simplified method of calculation and the assumptions used. (USGS)
W86-02886

MAPS SHOWING GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02889

MAPS SHOWING GROUND-WATER UNITS AND NUMBER OF LARGE-CAPACITY WELLS, BASIN AND RANGE PROVINCE, OREGON,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02890

MAPS SHOWING GROUND-WATER LEVELS, SPRINGS, AND DEPTH TO GROUND WATER, BASIN AND RANGE PROVINCE, OREGON,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02891

MAPS SHOWING OUTCROPS OF BASALTIC ROCKS OF EARLY QUARTERNARY AND TERTIARY AGES, BASIN AND RANGE PROVINCE, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02892

HYDROGEOLOGY OF THE CLIFTON PARK AREA, SARATOGA COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02894

RESULTS OF GEOHYDROLOGIC TEST DRILLING IN THE EASTERN SNAKE RIVER PLAIN, GOODING COUNTY, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02896

AQUIFER TESTS IN WEST-CENTRAL FLORIDA, 1952-76,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02899

EFFECTS OF FRACTURING ON WELL YIELDS IN THE COALFIELD AREAS OF WISE AND DICKENSEN COUNTIES, SOUTHWESTERN VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02900

GROUND WATER IN THE DICKSON AREA OF THE WESTERN HIGHLAND RIM OF TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02901

GROUND-WATER WITHDRAWALS FROM THE COASTAL PLAIN OF NEW JERSEY, 1956-1980,
Geological Survey, Trenton, NJ. Water Resources Div.
E. F. Vowinkel.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-226, 1984. 32 p, 8 fig, 3 tab, 38 ref.

Descriptors: *Groundwater, *Withdrawal, Coastal Plain, New Jersey, Aquifers, *Water use, Wells, *Atlantic coastal plain, *New Jersey, Potomac-Raritan-Magothy aquifer system, Atlantic City 800-foot sand, Englishtown aquifer, Kirkwood-Cohansey aquifer system.

Withdrawals and site data for wells with a pump capacity of 100,000 gallons per day or greater in the Coastal Plain of New Jersey are stored in computer files for 1956-80. The data are aggregated by computer into tables, graphs and maps to show the distribution of ground-water withdrawals. Withdrawals are reported by type of use and aquifer for each county in the Coastal Plain. Public-supply wells withdraw the largest quantity of ground water in the Coastal Plain, followed by industrial and agricultural wells. In 1980 public-supply withdrawals were about 280 million gallons per day; the maximum monthly rate was about 355 million gallons per day in July, and the lowest was about 215 million gallons per day in February. Average industrial withdrawals were about 65 million gallons per day. Ground-water withdrawals used for agriculture vary significantly during the year. In 1980, about 75 percent of the agricultural withdrawals occurred from June through September. Several aquifers are used as sources of water supply in the Coastal Plain. Five regional aquifers are the major sources of water for public-supply, industrial, or agricultural use. In decreasing order of withdrawals in 1980, in million gallons per day, they are: The Potomac-Raritan-Magothy aquifer system, 243; Kirkwood-Cohansey aquifer system, 70; Atlantic City 800-foot sand, 21; Englishtown aquifer, 12; and the Wenonah-Mount Laurel aquifer system, 5. (USGS)
W86-02911

GROUND-WATER WITHDRAWALS AND CHANGES IN THE WATER LEVELS IN THE HOUSTON DISTRICT, TEXAS, 1975-79,
Geological Survey, Houston, TX. Water Resources Div.
R. K. Gabrysch.
Available from: OFSS, USGS, Box 25425 Lakewood, CO 80225. Texas Department of Water Resources Report 286, 1984. 42 p, 22 fig, 4 tab, 25 ref.

Descriptors: *Groundwater, Aquifer characteristics, Aquifers, Land-surface subsidence, Saline water intrusion, Water supply, Water-level fluctuations, Groundwater pumping, *Chicot aquifer, Evangeline aquifer, Harris County, *Texas, Galveston County, *Withdrawals.

During 1975-79, total withdrawals of ground water in the Houston district decreased by 9.7 percent. This percentage represents a decrease from 505 million gallons per day during 1975, to 456 million gallons per day during 1979. The decrease resulted from an increased use of surface water that became available from Lake Livingston on the Trinity River during late 1976. During 1975-79, withdrawals of ground water decreased in the Pasadena, Katy, Baytown-La-Porte, Johnson Space Center, Texas City, and Alta Loma areas but increased in the Houston area. The decrease in withdrawals in the Kata area resulted partly from a small decrease in the acreage of rice planted, but mostly from a decrease in water needed for irrigation during 1979. The withdrawal of ground water increased in the Houston area because of the increase in population. The maximum rise of water levels in wells completed in the Chicot aquifer was 110 feet and for those completed in the Evangeline aquifer it was 150 feet. The maximum decline of water levels in wells completed in the Chicot aquifer was 60 feet; and for those completed in the Evangeline aquifer it was 70 feet. (USGS)
W86-02918

4C. Effects On Water Of Man's Non-Water Activities

OPERATION OF DETENTION FACILITIES FOR URBAN STREAM QUALITY ENHANCEMENT,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W86-02436

WETLANDS FOREST COMMUNITIES AS INDICATORS OF FLOODING POTENTIAL IN BACKWATER AREAS OF RIVER BOTTOMLANDS,
Arkansas Univ., Fayetteville. Dept. of Botany and Microbiology.
E. E. Dale.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211746/AS, Price codes: A05 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project Completion report, Pub. No. 106, Sept. 1984. 84 p, 3 fig, 37 tab. USGS G-829-08.

Descriptors: *Bottomland hardwoods, *Flooding, *Forests, Wetlands, Arkansas flooding potential, Flood forecasting, Flood plains.

A phytosociological study was made of forest types that occur in backwater and river bottomlands of the Gulf Coastal Plain, Arkansas Valley, and Mississippi Delta Regions of Arkansas. Twenty different forest types dominated principally by a single species were identified and described. Their occurrence was then correlated with flooding conditions in their habitats and the types were arranged along decreasing moisture gradients. Those forest types tolerant of flooding or saturated soils between three months to a year or more are Taxodium distichum, Nyssa aquatica, Cephalanthus occidentalis, Salix nigra, and Planera aquatica types. Those tolerant from one to three months are Forestiera acuminata, Carva aquatica, Quercus lyrata, and Fraxinum pennsylvanica. Those tolerant between one month and two weeks are Populus deltoides, Celtis laeigata, Ulmus americana, Acer negundo, Carya illinoensis, Quercus nutallii, Liquidambar styraciflua, Quercus phellos, Quercus nigra, Carya ovata and Quercus falcata var. pagodaefolis. It is concluded that forests of the study area are similar in vegetation composition to those of wetlands in Mississippi and Louisiana and that the same types occupy comparable habitats. Principal differences are that comparable wetland types in Arkansas usually cover less area and tend to support more species characteristics of drier habitats.
W86-02445

BIOHYDROLOGY OF MOUNTAIN FLUVIAL SYSTEMS: THE YELLOWSTONE (PARTS I AND II),
Montana Univ., Missoula.
For primary bibliographic entry see Field 6G.
W86-02452

EFFECT OF SALTWATER INTRUSION ON SOIL ERODIBILITY OF ALABAMA MARSHLAND,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W86-02552

HYDROLOGIC AND WATER QUALITY IMPACTS OF PEAT MINING IN NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Forestry.
For primary bibliographic entry see Field 5B.
W86-02696

SOME HYDROLOGIC ASPECTS OF PROPOSED COAL MINING IN THE NORTH FORK OF THE FLATHEAD RIVER HEADWATERS AREA, NORTHWEST MONTANA AND SOUTH EAST BRITISH COLUMBIA,
Montana Bureau of Mines and Geology, Butte.
R. A. Nobel, W. A. Van Voast, and J. L. Sonderagger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101268/AS, Price codes: A03 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Bozeman, Report No. 146, December, 1984. 26 p, 5 fig, 4 tab, 24 ref. USGS G-853-05. 14-08-0001-G-853.

Descriptors: *Coal mines, Strip mine waste, Groundwater, Surface water, Water quality, *Acid mine water, *Leachate, Trace elements, *Flathead River, *British Columbia, *Montana.

The proposed Cabin Creek coal mine in Canada, just north of the Montana-British Columbia border, has caused considerable concern in Montana because of its potential impact on the North Fork of the Flathead River. The objective of this project was to assess the impact of mining activity at the Cabin Creek site on water quality in the Flathead River. The results of the project indicate that acid mine drainage from the Cabin Creek mine should not be a problem. Analysis of the coal samples indicated that the acid-neutralizing potential exceeded the acid producing potential. Mineralization of waters entering the North Fork could result in some degradation of water quality, as could sediment from soil disturbances. The extent of degradation will depend on mining practices and on the location of retention facilities for water and other residual materials extracted from the mine.
W86-02707

BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN NORTH-CENTRAL MISSISSIPPI, AUGUST 1984,
Geological Survey, Jackson, MS. Water Resources Div.
S. J. Kalkhoff.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-327, 1985. 18 p, 5 fig, 3 tab, 8 ref.

Descriptors: *Lignite, *Water quality, *Surface water, Bottom sediments, Suspended sediments, *Coal mining effects, *Mississippi, Wilcox aquifer, Calhoun County, Lafayette County, Yalobusha County.

The U.S. Geological Survey, in cooperation with the Mississippi Department of Natural Resources, Bureau of Geology, is conducting a hydrologic data collection program in potential lignite-producing areas in Mississippi. During the last two weeks of August 1984, hydrologic data were collected at 15 stream sites that drain potential lignite mining areas in Lafayette, Calhoun, and Yalobusha Counties. Main channel widths ranged from approximately 60 feet at three streams (Coon Creek near Toccopula, Muckaloon Creek near Tula, and Hurricane Creek near Velma) to approximately 120 feet at two streams (Potlockney Creek near Tula, and Savannah Creek near Bruce). Maximum water depths ranged from less than 1.0 foot at most streams to over 5.0 feet at sites on Potlockney Creek near Tula and McGill Creek near Sarepta. Stream discharge ranged from 0.32 cubic feet per second in Persimmon Creek near Bruce to 18.5 cubic feet per second in Puskus Creek near Etta. The specific conductance of stream water ranged from 25 to 160 microsiemens and dissolved solids concentrations ranged from 22 to 91 mg/L (milligrams per liter). Most major ion concentrations were less than 10 mg/L with the exception of calcium (11 mg/L), sodium (12 mg/L) and sulfate (18 mg/L) in the water of Persimmon Creek near Bruce. Dissolved oxygen concentrations were greater than 5.0 mg/L at all but one site. Turbidity values were generally less than 50 units. Nitrate plus nitrite concentrations were equal to or less than 0.10 mg/L in all streams except in Potlockney Creek near Tula where the concentration was 0.11 mg/L. Copper and selenium concentrations in the water at all sampling sites ranged from below the detection limits (1 microgram/g) to 4 micrograms/g (micrograms per gram) and mercury concentrations in bottom material samples ranged from less than 0.01 microgram/g to 0.15 microgram/g. (USGS)
W86-02761

GROUND-WATER SYSTEM AND POSSIBLE EFFECTS OF UNDERGROUND COAL MINING IN THE TRAIL MOUNTAIN AREA, CENTRAL UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
G. C. Lines.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Supply Paper 2259, 1985. 32 p, 23 fig, 7 tab, 14 ref.

Descriptors: *Groundwater, *Dewatering, *Land subsidence, *Coal mines, *Mine water, Unconfined water, Confined water, Perched water, Hydraulic conductivity, Springs, *Utah, Drawdown, Water quality, Aquifer characteristics, Coal-mine subsidence, *Wasatch Plateau coal field.

Spring and well-test data indicate that ground water occurs in several aquifers in the Trail Mountain area. The coal-bearing Start Point-Blackhawk aquifer is regional in nature and is the source of most water in underground mines in the Wasatch Plateau coal field. In the Trail Mountain area, the Star Point-Blackhawk aquifer is overlain by one or more perched aquifers. Future underground coal mines will require dewatering when they penetrate the Star Point-Blackhawk aquifer. A finite-difference, three-dimensional computer model was used to make order-of-magnitude estimates of hypothetical mine inflows and drawdowns of potentiometric surfaces for various aquifer properties, premining hydraulic gradients, mine lengths and widths, and lengths of time. The computer simulations indicate that mine inflows could be several hundred gallons per minute and that potentiometric surfaces of the dewatered aquifer could be drawn down several hundred feet. Because the Star Point-Blackhawk aquifer is separated from overlying perched aquifers by an unsaturated zone, mine dewatering alone will not affect perched aquifers.

Mine dewatering will not significantly change water quality in the Star Point-Blackhawk aquifer. The effects of coal-mine subsidence on the groundwater system cannot be quantified. Subsidence fractures could extend from the roof of an underground mine into a perched aquifer several hundred feet above. Such fractures would increase downward percolation of water through the perching bed, and spring discharges from the perched aquifer could decrease. Also, flow through subsidence fractures could increase recharge to the Star Point-Blackhawk aquifer and increase inflow to underground mines. (USGS)
W86-02765

STATISTICAL APPROACH TO EVALUATING THE RELATION OF COAL MINING, LAND RECLAMATION, AND SURFACE-WATER QUALITY IN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
J. Hren, K. S. Wilson, and D. R. Helsel.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4117, 1984. 36 p, 9 fig, 13 tab, 13 ref.

Descriptors: *Water quality, *Statistical analysis, *Coal mines, *Land reclamation, Analysis of variance, Regression analysis, Correlation analysis, Discriminant function analysis, *Ohio.

Base-flow data from 779 sites in Ohio's coal region were analyzed statistically to relate land use to selected water-quality characteristics. Sites were classified into five categories: unmined (100 percent unmined land), abandoned (50 percent or more abandoned surface mines), reclaimed (50 percent or more reclaimed surface mines), deep-mined (50 percent or more underground mines), and mixed (all others). Specific conductance, pH, alkalinity, acidity, sulfate, dissolved iron, total iron, and total manganese in streams draining basins in the coal region were the eight characteristics selected for analysis. (USGS)
W86-02775

RUNOFF AND CHEMICAL LOADING IN SMALL WATERSHEDS IN THE TWIN CITIES METROPOLITAN AREA, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02794

QUALITY OF GROUND WATER IN MONITOR AND WILLIAMS TOWNSHIPS, BAY COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02798

U.S. GEOLOGICAL SURVEY URBAN-STORM-WATER DATA BASE FOR 22 METROPOLITAN AREAS THROUGHOUT THE UNITED STATES,
Geological Survey, Lakewood, CO. Water Resources Div.
N. E. Driver, M. H. Mustard, R. B. Rhinesmith, and R. F. Middelburg.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-337, 1985. 219 p, 1 fig, 102 tab, 58 ref.

Descriptors: Water quality, *Data bases, *Urban runoff, *Urban storm runoff, *Urban hydrology, Anchorage, Alaska, Fresno, California, Denver, Colorado, Miami, Florida, Tampa, Honolulu, Hawaii, Glen Ellyn, Illinois, Baltimore, Maryland, St. Paul, Minnesota, Kansas City, Missouri, Albuquerque, New Mexico, Long Island, New York, Rochester, Durham, North Carolina, Columbus, Ohio, Portland, Oregon, Rapid City, South Dakota, Austin, Texas, Houston, Salt Lake City, Utah, Bellevue, Washington, Milwaukee, Wisconsin.

The U.S. Geological Survey has been collecting urban rainfall, runoff, and water-quality data nationally for several decades. These data have been stored in many data bases and locations. A collective urban-stormwater data base has now been assembled on magnetic tape and contains data from the U.S. Geological Survey's urban-stormwater program, that includes data from the Nationwide Urban Runoff Program. Stations having simultaneous rainfall, runoff, and water-quality data were selected for the data base. Rigorous quality-assurance procedures were followed to ensure that the data were of good quality. The resultant data base contains information for 723 storms from 99 stations in 22 metropolitan areas throughout the United States. Data for five or more storms are available for about two-thirds of the stations. This data base is available to the public in standardized format on magnetic tape. This publication explains the content and format of the tape. (USGS)
W86-02808

DATA COLLECTED BY THE U.S. GEOLOGICAL SURVEY DURING A STUDY OF URBAN RUNOFF IN BELLEVUE, WASHINGTON, 1979-82,
Geological Survey, Tacoma, WA. Water Resources Div.
J. C. Ebbert, J. E. Poole, and K. L. Payne.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-064, 1985. 255 p, 8 fig, 3 pl, 33 tab, 9 ref.

Descriptors: *Urban runoff, Detention reservoirs, *Water quality, Precipitation, Discharge measurement, Chemical analysis, Physical properties, *Water pollution sources, *Washington.

From October 1979 through January 1982 the U.S. Geological Survey conducted an urban-runoff study in Bellevue, Washington. The study, done in cooperation with the City of Bellevue, was part of the U.S. Environmental Protection Agency's National Urban Runoff program. The objectives of the study were to (1) establish a consistent and accessible data base for typical urban watersheds; (2) determine the magnitude and frequency of storm-runoff loads of water-quality constituents from three catchments in the city; (3) develop methods for estimating storm and annual loads of water-quality constituents from unsampled catchments in the study area; and (4) test the effectiveness of storm-water-quality management alternatives, such as street sweeping and detention storage, for the attenuation of constituent loads carried in storm runoff. This report presents data collected during the study period. Data include rainfall and runoff amounts, physical characteristics of the catchments, the chemical quality of storm runoff and in wet- and dry-atmospheric deposition, constituent loads in storm runoff and in wet- and dry-atmospheric deposition, and storm characteristics data, such as rainfall and runoff volumes. (USGS)
W86-02811

ANALYSIS OF URBAN RUNOFF DATA AND EFFECTS ON THE SOUTH PLATTE RIVER, DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02813

RUNOFF AND WATER QUALITY CHARACTERISTICS OF SURFACE-MINED LANDS IN ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
T. P. Brabets.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4265, 1983. 78 p, 30 fig, 14 tab, 20 ref.

Descriptors: *Flow characteristics, *Streamflow, *Illinois, Surface water, Water quality, *Flood peak, *Flow duration, Variability, Data collection, Storm runoff, Coal mining, Climatic data, Specific conductivity, Sulfates, Calcium, Suspended sediments, Aluminum, Iron, Magnesium, Zinc, Trace metals, Fulton County, St. Clair County, Williamson County, *Surface mining.

Seven watersheds--three in western Illinois (Fulton County), two in south-western Illinois (St. Clair County), and two in southern Illinois (Williamson County)--were selected to assess the effect of surface mining on the quality and quantity of surface runoff. Each area had one site draining an unmined basin and a nearby site(s) draining a partly surface-mined basin. Flow-duration curves for streams draining surface-mined land had lower variability than those from unmined land. By adjusting an index of variability according to the percentage of surface-mined land in a basin, present techniques can be used to develop synthetic flow-duration curves. Surface mining changes basin characteristics so that peak flows decrease and low flows increase. Regression equations were developed relating storm runoff volume and peak discharge to basin characteristics and climatological data. Concentrations of dissolved solids, sulfate, and calcium were higher in streams draining extensively mined areas. Different mining areas of Illinois yield regional differences in concentrations of these substances. Surface-mined basins had lower suspended-sediment yields than unmined basins. (USGS)
W86-02826

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE WEST OTTER AREA, ASHLAND AND BIRNEY-BROADUS COAL FIELDS, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
N. E. McClymonds.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4087, 1984. 111 p, 16 fig, 10 tab, 33 ref.

Descriptors: Hydrology, Coal, Streamflow, Groundwater reservoirs, *Coal mining, Sandstone, Alluvium, Aquifers, Water quality, Otter Creek, Ashland coal field, Birney-Broadus coal field, *Montana, *Groundwater, *Surface mining.

Shallow aquifers exist primarily within the Tongue River Member of the Paleocene Fort Union Formation and within valley alluvium. Sandstone beds are the principal aquifers for domestic supply and livestock watering, with the Knobloch coal bed being a secondary source of supply. Surface-water resources consist principally of perennial flow in Otter Creek and intermittent flow in eight small drainage basins. The small streams are generally dry at their mouth, except after intense rainfall or sudden snowmelt. Otter Creek is used for livestock watering and, during spring floods, for irrigating alfalfa fields. The water supplied by wells generally is a sodium bicarbonate type. Dissolved-solids concentrations of water samples ranged from 480 to 3,460 milligrams per liter in sandstone beds and from 910 to 6,260 milligrams per liter in the Knobloch coal bed. Water in Otter Creek contains principally sodium, magnesium, and sulfate ions. The dissolved-solids concentration ranged from 2,050 to 2,950 milligrams per liter. Mining of the Knobloch coal bed would remove three private wells and adversely affect the yield of two other wells. After mining, water in the alluvium of Otter Creek might show long-term degradation in water quality as a result of waters leaching the soluble salts from the spoils material used to backfill the mine pits. Although mining would alter the existing hydrologic systems and remove several shallow wells, alternative ground-water supplies are available from deeper aquifers that could be developed to replace those lost by mining. (USGS)
W86-02827

GROUND-WATER RESOURCES AND POTENTIAL HYDROLOGIC EFFECTS OF SURFACE COAL MINING IN THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
S. E. Slagle, B. D. Lewis, and R. W. Lee.
Available from Dist Branch, USGS 604 S. Pickett St Alexandria, VA 22304. USGS Water-Supply Paper 2239, 1985. 34 p, 14 fig, 7 tab, 114 ref.

Descriptors: *Groundwater resources, Surface waters, *Water quality, Strip mines, Powder River Basin, Shallow groundwater, Fort Union Formation, *Coal mining effects, *Montana, *Water pollution sources.

The shallow ground-water system in the northern Powder River Basin, Montana consists of Upper Cretaceous to Holocene sedimentary rocks of the Fox Hills, Sandstone, Hell Creek, Fort Union, and Wasatch Formations, terrace deposits, and alluvium. Groundwater in the system has both localized and regional flow patterns. Most water in the shallow aquifers does not meet standards established by the U.S. Environmental Protection Agency for public supply. Average dissolved-solids concentration is 2,100 mg/L for water at depths of less than 200 feet and 1,400 mg/L for water at depths between 200 and 1,200 feet. Effects of surface mining on the water resources in the northern Powder River Basin are largely dependent on the stratigraphic location of the mine cut. Where the cut lies above the water-yielding zone the effects will be minimal. Where the mine cut intersects a water-yielding zone, effects on water levels and flow patterns locally can be significant, but they will return to approximate premining conditions after mining ceases. Mineralization of ground water near former mines may occur locally owing to the exposure of fresh mineral surfaces in the spoils. Regional effects will probably be small because of the limited areal extent of ground-water flow systems where mining can occur. Results of digital models are presented to illustrate the effects of varying hydraulic properties on water-level changes resulting from mine dewatering. During October 1, 1979 - August 31, 1980, the discharge-weighted average concentrations of dissolved solids was 195 milligrams per liter in the combined inflow to the reservoir. The smaller concentration in the outflow was due primarily to precipitation of calcium carbonate in the reservoir--about 80 percent of the decrease can be accounted for through loss as calcium carbonate. (USGS)
W86-02841

SYNTHESIZED FLOOD FREQUENCY OF URBAN STREAMS IN ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
D. A. Olin, and R. H. Bingham.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 82-683, 1982. 23 p, 13 fig, 3 tab, 19 ref.

Descriptors: Urbanization, *Urban runoff, *Flooding, *Frequency analysis, Surface waters, Analytical techniques, Parametric hydrology, Regression analysis, Hydrology, *Alabama, Flood frequency, *Urban streams.

Equations have been developed for estimating future floods for 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals on urban streams in Alabama with drainage areas of about 0.15 to 85 square miles. One equation for each recurrence interval applies statewide. The equations were derived by multiple regression analyses of flood magnitudes obtained from synthetic discharge data generated with a calibrated rainfall-runoff model and basin characteristics. The regression analyses indicated that drainage area size and percentage of the basin occupied by impervious materials are the most significant basin characteristics affecting flood frequency and magnitude of urban streams. Mathematical procedures used to analyze the observed and synthetic data are described. Also included are flood-frequency data for stations used in the analyses and computations demonstrating application of the regression equations to urban streams in Alabama. (USGS)
W86-02856

EFFECTS OF SURFACE COAL-MINE RECLAMATION ON STREAM QUALITY IN A SMALL WATERSHED NEAR NELSONVILLE, SOUTHEASTERN, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02867

EFFECTS OF RELOCATING STATE ROUTE 151 ON THE FLOOD PROFILES OF CONOTTON CREEK AND ITS TRIBUTARIES BETWEEN BOWERSTON AND SCIO, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
W. P. Bartlett, B. E. Krejmas, R. I. Mayo, and S. W. Wandle.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4130, 1984. 46 p, 10 fig, 3 tab, 10 ref.

Descriptors: *Design floods, *Flood profiles, Flood recurrence interval, *Highway relocation, Harrison County, *Ohio, Conotton Creek.

The Ohio Department of Transportation proposes to relocate an 8-mile segment of State Route 151 between Bowerston and Scio, Harrison County, Ohio. About 3.1 miles of this relocated highway will be within the flood plain of Conotton Creek or its tributaries. Water-surface profiles of the 100-year flood before and after the highway relocation are virtually the same between Bowerston and the western coorporation limits of Scio. Upstream from that point to the upper end of the study reach, the modified profile would be about 1 foot lower than for existing conditions. (USGS)
W86-02872

SUMMARY OF URBAN-RUNOFF STUDIES IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02875

HYDROLOGY OF A SURFACE COAL MINED AREA IN RANDOLPH COUNTY, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02897

HYDROLOGY OF AREA 56, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, UTAH AND COLORADO,
Geological Survey, Salt Lake City, UT. Water Resources Div.
G. C. Lines.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-38, 1984. 69 p, 54 fig, 7 tab, 57 ref.

Descriptors: Water resources, *Groundwater, *Surface waters, Water quality, *Coal mines, *Utah, *Colorado, Hydrologic data, *Hydrologic impacts, Underground mines, Hydrologic studies.

Area 56 is one of 20 hydrologic areas defined in the Northern Great Plains and Rocky Mountain Coal Provinces. Area 56 includes the Wasatch Plateau, Book Cliffs, Emery, and Henry Mountains coal fields in central and southeastern Utah and west-central Colorado. All coal mined on the area during 1980, was recovered by underground mining techniques, and was mainly from the Wasatch Plateau and Book Cliffs fields. Surface mining is possible in the Emery and Henry Mountains fields. Hydrologic impacts related to coal mining in the area are due mainly to dewatering of mines and land subsidence. Dewatering of coal mines changes the flow pattern through coal-bearing aquifers, and storage in aquifers is reduced. Land subsidence and associated rock fracturing above underground mines could change the flow of springs and locally could alter surface runoff. Other impacts of mining are increases in streamflow and degradation of surface-water quality downstream from points of mine discharge. The report provides broad hydrologic information for the area, using a brief text accompanied with maps, graphs, and tables for each of a series of water-resources related topics. Sources of additional hydrologic information are identified. The report is designed to be useful to coal-mine operators, consulting engineers, and regulatory authorities. (USGS)
W86-02913

4D. Watershed Protection

PREVENTION OF GULLY FORMATION AND ASSOCIATED WATER DEGRADATION IN WEST TENNESSEE,
Tennessee Water Resources Research Center, Knoxville.
For primary bibliographic entry see Field 2J.
W86-02538

ASSESSING WATER-SHORTAGE RISK OF RESERVOIRS BY STOCHASTIC SIMULATION,
Kansas Water Resources Research Inst., Manhattan.
Y. S. Yu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232940/AS, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, September 1984. 40 p, 11 fig, 11 tab, 5 ref. USGS G843-05.

Descriptors: *Kansas, Reservoirs, Water shortage risk, Water use options, Conservation practices, *Water requirements, Irrigation, Fish hatcheries, Municipal supply, Water supply, Reliability, Firm yield.

The water-shortage risk of Cedar Bluff Reservoir for various water-use options has been evaluated by simulated operation of the reservoir. In the reservoir operation study, the present level monthly inflows were used. The present level inflows are equal to either the historic monthly inflows subtracted by an estimated depletion due to well development and conservation practices in place at the 1980 level or the synthetic monthly inflows subtracted the depletion. The synthetic monthly inflow series is generated by a disaggregation model. The monthly inflow series is 43 years long. The water requirements include the releases for irrigation, fish hatchery and the City of Russell. Various sizes of irrigation project investigated 6800, 3000, 2000, 1500 and 1300 acres. For each case, the reliability of the water supply, the magnitude of water shortages and the frequency distribution of the pool level in the long-term operation are determined. The results show that the firm annual yield of the reservoir is 3600 ac-ft or 300 ac-ft per month. The water supply is 100% reliable for irrigating 2000 acres of irrigated land. With additional releases for fish hatchery, the reliability of the water supply is reduced to 88%. The water supply is fully adequate for irrigating 6800 acres of land in 24 years out of 43 years of operation. The reliability is only 56%.
W86-02639

RIPARIAN ZONE SYSTEMS, USES, AND MANAGEMENT,
Oregon State Univ., Corvallis. Water Resources Research Inst.
W. D. Honey, R. J. Seidler, and P. C. Klingeman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-246742/AS, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute, Corvallis, August 1984. 69 p, 14 fig, 30 ref. USGS G864-22. 14-08-0001-G-864.

Descriptors: *Riparian land, Riparian systems, *Riparian ecosystems, *Riparian vegetation, *Riparian waters, *Riparian zones, *Riparian zone management, *Ecosystems, *Aquatic ecosystems, Aquatic environment, *Aquatic habitats, Aquatic insects, Aquatic life, Aquatc plants, Stream biota, Aquatic productivity, Management, *Watershed management, *Range management, Agriculture, Wastewater, *Oregon.

A comprehensive overview is presented of riparian zone systems, uses and management. The presentation is divided into two parts. Part I describes the

natural features and processes found in riparian zones. Included are the basic concept of a riparian zone, ecosystem organization and biological processes in the riparian zone, vegetational systems and organic matter, wildlife, chemical processes, and the fluvial processes which shape the zone. Part II describes major types of human uses of riparian zones and the management methods that have evolved to sustain such uses. Included are forestry, livestock grazing, agriculture, sand and gravel extraction, mining, dams and diversions, transportation, recreation, aesthetics, municipal and industrial requirements, and urban developments. The concepts and related information cut across traditional disciplines so that the many facets of riparian zones can be treated as a unit.
W86-02668

RIPARIAN SHRUBBY VEGETATION PROTECTION AGAINST HERBIVORE BROWSING,
Oregon State Univ., Corvallis. Dept. of Rangeland Resources.
J. C. Buckhouse.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-246767/AS, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute Publication WRRI-94, Corvallis, August 1984. 8 p, 3 fig, 1 tab, 5 ref. USGS G864-04. 14-0001-08-864.

Descriptors: *Riparian vegetation, *Grazing, *Vegetation establishment, Revegetation, Bank protection, Vegetation regrowth, Animal behavior, Range management.

Vexar(R) tubing, nylon mesh netting, and big game repellent (BGR) were tested under field and 'feedlot' trial conditions to determine their effectiveness as browsing protection devices for young willows. It was found that under certain environmental conditions, willow browsing protecting devices and treatments may have some value against rodents and deer but that their long-term protection value against cattle may be slight or even negative. Under field conditions, during 1983-1984 in the absence of domestic livestock, the nylon mesh, Vexar (R) tubes, and BGR provided some browsing protection some browsing protection against beaver and deer. Browsing frequencies were 13%, 19%, and 26% respectively, compared to 45% at controls. Several problems were encountered: the nylon mesh matted to the ground following periods of snow and tended to lie prostrate in high, rushing waters; the Vexar(R) tubes withstood snow crushing but were vulnerable to peak water flows; both the netting and tubes were highly visible and subject of heavy vandalism by fishermen, trappers, and recreationists; and the longevity of BGR following precipitation is unknown. A feedlot trial was conducted during spring 1984 to determine what protection these devices might offer against livestock browsing. The Vexar(R) tubes were essentially neutral; frequency of browsing (72%) was similar to the untreated control plants (70%). The BGR offered a moderate degree of protection (60% browsing frequency). The nylon mesh netting, however, attracted the animals (91 browsing frequency).
W86-02670

ANNUAL SUSPENDED-SEDIMENT LOADS IN THE COLORADO RIVER NEAR CISCO, UTAH, 1930-82,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-02828

SEDIMENT CHARACTERISTICS OF TENNESSEE STREAMS AND RESERVOIRS,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-02829

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

STREPTOCOCCI AS INDICATORS OF SOURCE AND TYPE OF SURFACE WATER CONTAMINATION,
Vermont Univ., Burlington. Dept. of Microbiology and Biochemistry.
R. E. Sjogren.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214526/AS, Price codes: A03 in paper copy, A01 in microfiche. Vermont Water Resources Research Center Completion Report, Burlington, September, 1984. 37 p, 5 tab, 10 fig, 26 ref. USGS G873-03.

Descriptors: *Bioindicators, Surface water, Water quality, *Bacteriological indicators, *Streptococci, *Vermont.

Environmentally significant streptococci were isolated on a newly developed medium, and identified to species level using a rapid biochemical test screen composed of tubed, plate and Minitek plate system. The numbers of identified species of Streptococcus were expressed as bars in a graph whose overall appearance constituted a population profile or signature. Visual and statistical analysis of these data by sample sites indicated that this approach holds promise as a means of identifying the source and type of microbial pollution entering surface waters.
W86-02456

MERCURY IN PEAT AND ITS DRAINAGE WATERS IN EASTERN NORTH CAROLINA,
Duke Univ., Beaufort, NC. Marine Lab.
R. T. DiGiulio, D. W. Evans, and E. A. Ryan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214823, Price codes: A05 in paper copy, A01 in microfiche. Project Completion Report, North Carolina Water Resources Research Institute, Report No. 218, Raleigh, September, 1984. 80 p, 6 fig, 23 tab, 114 ref. USGS G860-02.

Descriptors: *North Carolina, *Peat mining, *Drainage waters, *Mercury, *Water pollution effects, Peat, Clams, Leaching, Aquatic environment, Mine drainage.

Mercury concentrations were measured by cold vapor atomic absorption spectrophometry in samples of peat and peatland drainage waters in both the western Pamlico-Albemarle Peninsula and Croatan National Forest of eastern North Carolina. Mercury concentrations were also measured in sediments, waters, and the benthic clam, Rangia cuneata, in the Pungo River which receives drainage from the former area. Total Hg concentrations measured ranged from 40 to 193 ng/g (dry weight) in peat, less than 2 to 20 ng/g dry weight in sediments, 25 to 32 ng/g wet weight in clams and less than 2 to 23 ng/L in water. These concentrations are all at the low end of the range of Hg concentrations in uncontaminated aquatic environments which indicates the absence of any identifiable Hg pollution under current conditions. The water concentrations, in particular, were all less than the current North Carolina water quality standard of 50 ng/L. Mercury in peat, sediments and water was largely associated with and strongly bound to organic matter which would restrict its biological availability to aquatic organisms. Peatland drainage appears to contribute slightly elevated Hg concentrations to receiving waters but these remain low. Mobilization of Hg from peat to drainage waters during mining would probably be minor as indicated by both sampling in experimental mining plots and drainage canals and simulated aerobic leaching of peat with deionized water.
W86-02485

RAPID DETECTION AND IDENTIFICATION OF BACTERIA IN SEWAGE AND NATURAL WATERS BY MEANS OF TIME-RESOLVED LASER SPECTROSCOPIES,
Rhode Island Univ., Kingston. Dept. of Chemistry.
W. H. Nelson, and J. F. Sperry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214864/AS, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, Rhode Island Water Resources Research Center, Kingston, September, 1984. 12 p, 7 fig, 4 ref. USGS G867-02.

Descriptors: *Rhode Island, *Water resources research, *Pollutant identification, *Bacteria, *Resonance Raman, *Time-resolved fluorescence, Visible, Ultra-violet spectra, Detection, Identification.

The authors have excited samples of chromobacteria containing as few as 25 organisms and have obtained excellent spectra with 488 nm excitation. Thus, they have shown that the resonance Raman method potentially is a highly sensitive means of detecting and identifying bacteria. There is potential both for remote detection and detection from complex mixtures. Fluorescence emission data have demonstrated that measurable fluorescence does not occur below 285-290 nm in all of a wide variety of cultures. This is highly significant since most bacteria are not intensely colored and cannot be studied by resonance Raman using visible light, but tend to be fluorescent in the region 300-500 nm. Results suggest that resonance Raman spectra of DNA components taken with 220-280 nm excitation will be obtained with high sensitivity and will contain a maximum amount of information which can be related to the taxonomy of the micro organisms. The time-resolved fluorescence spectra of several types of bacteria have been obtained at various emission wavelengths. Our data suggest the determination of fluorescence lifetimes will be an effective means of bacterial identification even if all the fluorescence components are not resolved.
W86-02489

CONTINUOUS SYNTHESIS OF RUNOFF FROM THE KAWISHIWI RIVER IN NORTHEASTERN MINNESOTA,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 2E.
W86-02518

DEVELOPMENT OF A SIMPLIFIED CHLORINATED HYDROCARBON SCREENING TECHNIQUE FOR WATER AND SEDIMENT,
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
P. Templet.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-219038/AS, Price codes: A02 in paper copy, A01 in microfiche. Technical Completion Report, Louisiana Water Resources Research Institute, Baton Rouge, August 1984. 9 p, 1 fig, 2 tab, 20 ref. USGS G845-04.

Descriptors: *Chlorinated hydrocarbons, *Sediments, *Water analysis, *Phenols, Monitoring, *Louisiana.

The development of a simple screening technique for chlorinated hydrocarbons in water and sediment was undertaken. Extraction and concentration techniques were used as an alternative to the present costly and time consuming methods. Water samples spiked with known amounts of six chlorinated hydrocarbons were passed through Sep-Paks, a Waters Assocs. C-18 disposable column, and the adsorbed compounds eluted with methanol. The methanol extract was analyzed directly by furnace evaporation and decomposition into a microcoulometer cell and reported as total organic halide (TOX). Recoveries were variable and were a function of the Sep-Pak loading, concentration and volume of samples and type of chlorinated hydrocarbon. Chlorinated phenols exhibited the best recoveries (100%) and volatile compounds the worst (20%). The technique offers promise as a qualitative screening procedure for natural waters. Dried sediment were spiked with known amounts of the

same six chlorinated hydrocarbons, extracted with hexane and analyzed for TOX using furnace microcoulometry. Sediments run directly without the extraction step exhibited interferences from naturally occurring sulfur compounds and inorganic chlorides. The extraction step affords an additionally opportunity for a 100-fold concentration. Recoveries ranged from 100% (PCB and chlorophenols) to 20-30% (Tetrachloroethylene and chloroform) for volatile compounds. The lower recoveries may never be encountered in field samples since volatiles may have already been evaporated from the sediment or soil.
W86-02550

EFFECTS OF POLLUTION ON GROWTH OF MIDWESTERN MUSSEL SHELLS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5C.
W86-02563

DETERMINATION OF TOXIC ORGANIC COMPOUNDS IN DISCHARGE WATER FROM HYDROSTATIC TESTING OF NATURAL GAS PIPELINES,
New Mexico State Univ., Las Cruces. Dept. of Chemistry
G. A. Eiceman, and B. Davani.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-229730/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, New Mexico Water Resources Research Institute, Las Cruces, October 1984. 32 p, 14 fig, 5 tables, 10 ref. USGS G-858-04.

Descriptors: *New Mexico, *Toxic wastes, *Water pollution sources, Pipelines, *Natural gas, Organic compounds, Water pollutants, Discharge water, Hydrostatic testing.

Hydrostatic testing of natural gas pipelines may lead to production of water which is contaminated with organic compounds in a highly complex mixture. Present in this complex mixture are benzene, C-1 to C-5 alkylated benzenes, dimethyl disulfide, C-3 to C-5 alkylated dissulfides, saturated alkanes, and branched/unsaturated alkanes. Estimated minimum concentrations of benzene were 25 to 38 mg/L. In the second study, a complex mixture of polycyclic aromatic hydrocarbons (PAH) and alkylated polycyclic aromatic hydrocarbons was identified and determined quantitatively in discharge water from hydrostatic testing of natural gas pipelines (DWHT). Over 150 PAH or alkylated PAH were detected in portions of DWHT using solvent extraction for prefractionation and concentration. Concentrations of total PAH content showed a clear decreasing trend throughout dewatering from high value of 32,000 g/L at start to less that 8,000 micrograms/L toward the end of the discharge. This trend was parallel with bulk hydrocarbon concentrations or COD values in the aqueous samples. Consequences for environmental release and disposal practices are discussed based on these results. Natural gas was found to contain organic compounds with carbon numbers between 10 to 28 in addition to methane and heptane. These compounds were present at total concentrations of about 100 mg/cu m and were easily detected by passing natural gas directly through glass cold traps. Components were resolved using gas chromatography and identified using gas chromatography/mass spectrometry. Major components included n-alkanes, branched alkanes, alkylated benzenes, and several aromatic hydrocarbons such as substituted naphthalenes and biphenyls.
W86-02602

NEW APPROACHES FOR ON-LINE STRIPPING ANALYSIS OF TRACE METALS IN NATURAL WATERS,
New Mexico State Univ., Las Cruces. Dept. of Chemistry
For primary bibliographic entry see Field 2K.
W86-02608

DEVELOPMENT OF A PRIMER ON WELL WATER SAMPLING FOR VOLATILE ORGANIC SUBSTANCES,
Arizona Water Resources Research Center, Tucson.
For primary bibliographic entry see Field 7B.
W86-02612

VERIFICATION OF SHORELINE SEWAGE LEACHATES IN FLATHEAD LAKE, MONTANA,
Montana Univ., Bigfork. Biological Station.
For primary bibliographic entry see Field 5B.
W86-02619

SUITABILITY OF SELECTED ORGANISMS FOR MONITORING LEACHATE AT A REFUSE DISPOSAL SITE,
South Dakota State Univ., Brookings. Dept. of Civil Engineering.
J. N. Dornbush.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232825/AS, Price codes: A05 in paper copy, A01 in microfiche. Project Completion Report, South Dakota Water Resources Research Institute, Brookings, December, 1984. 78 p, 9 tab, 6 fig, 22 ref, 4 append. USGS G-869-04. 14-08-0001-G-869.

Descriptors: *South Dakota, *Water pollution monitoring, *Bioindicators, *Landfill, *Leachate, *Bullheads, *Cattails, Groundwater, Surface interaction trench, Heavy metals.

The Brookings, SD landfill is located over a sand and gravel aquifer with a water table only a few feet below ground. A trench and ponds have been excavated to intercept and treat leachate-contaminated plumes from the landfill. Monitoring wells downstream from the trench have not violated drinking water standards. The objective of this study was to evaluate the potential of biological monitoring of leachate contaminants in the trench. Black bullheads (Ictalurus melas) and narrow-leaf cattails (Typha angustiforlia) were evaluated as potential biological accumulators or concentrators of low-level leachate contaminants. Neutron activation analysis (NAA) and gas-liquid chromatography revealed detectable levels of mercury, vanadium and polychlorinated biphenyls in the bullheads to demonstrate their potential of biomonitoring these toxics. Mercury levels of landfill fish were below 0.5 ppm although concentrations were higher than in control bullheads from a nearby borrow-pit lake. PCB's were detected in all bullhead liver samples but below the 2 ppm MCL established by FDA. Bromine, chlorine, cobalt and potassium were revealed by NAA in narrow-leaf cattails at higher concentrations at the landfill and considered to have the potential for monitoring. Sodium was lower than in the control. Chlorine concentrations increased 250% in cattails suggesting their monitoring use for defining plume direction and locating monitoring wells.
W86-02627

REPLICATION OF HUMAN ROTAVIRUS IN TISSUE CULTURE: RECOVERY AND DETECTION IN FECAL, SEWAGE, AND NATURAL WATER SAMPLES,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
R. S. Fujioka, E. B. Siwak, and P. C. Loh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232858/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. 161, June, 1984. 24 p, 19 tab. USGS G838-02. 14-08-0001-G838.

Descriptors: *Viruses, *Enterovirus, *Pathogens, Sewage, Water pollution, *Hawaii, *Rotavirus, *Tissue culture, ELISA.

Human rotavirus is the major cause of gastroenteritis among young children. To replicate this virus, sensitive methods using standard tissue culture systems are required. The project goal was to develop laboratory capability to recover and detect this infectious rotavirus in fecal, sewage, and natural water samples. Using simian rotavirus (SA-11) as a model system and an enzyme-linked immunosorption (ELISA) test capable of detecting high concentrations of rotavirus, the protamine sulfate method was determined as superior to the aluminum chloride precipitation and polymer two-phase methods for recovering rotavirus from sewage. The ELISA method was very effective in detecting rotavirus in stool samples of children. Stools from children not displaying clinical symptoms of rotavirus infection were negative for rotavirus, whereas 43 to 58% of stools from children displaying clinical symptoms of rotavirus infection was positive for rotavirus. The results suggested an association of increased rotavirus infections during the winter months in the state of Hawaii. Stools positive for rotavirus by the ELISA test were used as inoculum to develop methods to replicate human rotavirus in the cell culture system. After many unsuccessful attempts, human rotavirus was cultured after two passages in primary cynomolgus monkey kidney cells. Human rotavirus which replicated in the primary monkey kidney cells was shown to be capable of replicating in continuous monkey kidney cells lines such as the MA-104.
W86-02630

BUFFER CAPACITIES OF FRESHWATER LAKES SENSITIVE TO ACIDIC RAIN AND THE LEACHING OF TOXIC METALS FROM THEIR SEDIMENTS,
Rutgers - The State Univ., New Brunswick, NJ. Div. of Water Resources.
R. Schmidt, and S. D. Faust.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232908/AS, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, New Jersey Water Resources Research Institute, New Brunswick, April, 1985. 32 p, 12 ref, 10 fig. USGS G857-04. 14-08-0001-G-857.

Descriptors: *Acid rain, Acid precipitation, Leaching, Heavy metals, Prediction, Lake sediments, Alkalinity, *New Jersey.

The primary goals of this project were to define the buffer capacity of seven fresh water lakes in two different geologies in New Jersey and to determine if significant amounts of trace metals were leached from lake sediments. Data collected showed pH values and alkalinities in six of the seven lakes have probably not decreased due to acidic deposition. The seventh lake, Catfish Pond, is highly acidic. The two lakes which appeard to be the most buffered, White Meadow Lake and Lake Marcia, seem to derive their buffer capacities from the weathering of the clay mineral illite in their sediments; this finding supports the concept that lake bottom sediments may participate in acid neutralization. In six of the lakes, there was no indication that sediments released increased amounts of aluminum, cadmium, lead and zinc into the water column. Catfish Pond, however, exhibited elevated concentrations of aluminum, lead and zinc in the water column. The concentrations of trace metals in two drinking water reservoirs, Split Rock and Clyde Potts, did not exceed potable water standards for New Jersey.
W86-02635

STUDY OF THE MECHANISMS CONTROLLING GASOLINE HYDROCARBON PARTITIONING AND TRANSPORT IN GROUNDWATER SYSTEMS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5B.
W86-02659

ADSORPTION OF METAL IONS AND MINERAL COMPLEXES ON MINERALS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W86-02662

DETECTION AND EFFECTS OF APERIODIC LEACHATE DISCHARGES FROM LANDFILLS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5B.
W86-02663

CHANGES IN THE SPECIES AND CONCENTRATION OF CARBON, NITROGEN AND SULFUR COMPOUNDS DURING THE ROD TEST AND THEIR EFFECT ON OXYGEN UPTAKE,
Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering.
L. Del Valle.
Available from the National Technical Information Services, Springfield, VA 22161 as PB85-246791/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, Puerto Rico Water Resources Research Institute, Mayaguez, Sept 1984. 31 p, 17 fig, 1 tab, 10 ref. OWRT A-073-PR(1). 14-34-0001-2141.

Descriptors: *Biological oxygen demand, *Water analysis, Nitrification, Sulfur compounds, Organic compounds, Oxygen balance.

The main objective of this study was to obtain a better view of the BOD test, by observing the effect of nitrification and of the oxidation of other possible oxygen-consuming substances, such as sulfur compounds, and to develop a method by which the results of the standard BOD test could be corrected by stoichiometry, so that the final results of the test would only reflect the actual amount of oxygen used in the oxidation of carbonaceous organic matter. Tests were run on wastewater treatment plant effluents in which the changes in oxygen concentration in the samples were measured on a day by day basis, as well as changes in sulfates, nitrites, nitrates, and alkalinity. Some parallel 'inhibited' BOD tests were also run. It was discovered that under the conditions of the standard BOD test there is no significant interfering effect of sulfur compounds in the test. Nitrification was measured, although the effect was not great in the analyzed samples. Stoichiometric corrections for nitrification were applied to the BOD values obtained in the standard BOD test. These 'corrected' BOD values were smaller than the standard values and about the same as the results of the 'inhibited' BOD test. Excellent correlation was found between the 'corrected' and the 'inhibited' BOD values. It may be concluded that both the 'corrected' and the 'inhibited' BOD tests are better parameters than the standard test, in which to rely on the performance evaluation of wastewater treatment plants.
W86-02673

SELECTIVE ISOLATION OF DISSOLVED ORGANIC MATTER FROM AQUATIC SYSTEMS,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 2K.
W86-02700

INVESTIGATION OF POLLUTION IN A KARST AQUIFER UTILIZING OPTICAL BRIGHTENER,
Kentucky Water Resources Research Inst., Lexington.
J. Thrailkill, R. F. Wiseman, and B. R. Scanlon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132404/AS, Price codes: A03 in paper copy, A01 in microfiche. USGS G-908-07. 14-08-0001-G-908 (FY 84).

Descriptors: *Groundwater, *Groundwater pollution, Optical properties, Biological properties, *Kentucky, *Karst hydrology, *Tracers, *Path of pollutants, *Optical brightener, Coliforms.

Optical brightener is an additive to laundry detergents and often contaminated groundwater. Its concentration may rapidly and inexpensively be determined by fluorescence techniques, and because its source is human waste water, its presence in groundwater serves as a direct indication of pollution from septic tanks, sewer leaks, and landfills. A total of 105 wells and springs in an area within the Inner Bluegrass Karst Region near Lexington, Kentucky, were described and sampled. Analyses were made for optical brightener (430 samples), total coliform (91), fecal coliform (93), and fecal streptococci (90). As many as 20 optical brightener and 4 bacterial samples were analyzed from a single site during the period from May 20, 1984 to June 17, 1985. Data were also collected on spring discharges, well water levels, and other site characteristics. Statistical analysis of the relationship between optical brightener and the bacterial indices showed low correlation for both spring and wells, in contrast to an earlier study. Although time constraints have precluded a thorough analysis of the data the difference between the results of the two studies appear to be related to differing site populations and analytic and statistical procedures. The data further suggest that the low correlations between optical brightener and the bacterial indices may be a result of bacterial contamination being largely derived from animal waste and other non-human sources, and that optical brightener may be a more reliable indicator of human contamination.
W86-02740

BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN NORTH-CENTRAL MISSISSIPPI, AUGUST 1984,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02761

PESTICIDES IN THE NATION'S RIVERS, 1975-1980, AND IMPLICATIONS FOR FUTURE MONITORING,
Geological Survey, Reston, VA. Water Resources Div.
R. J. Gilliom, R. B. Alexander, and R. A. Smith.
Available from Distribution Br, USGS 604 S. Pickett St. Alexandria, VA 22304. USGS Water-Supply Paper 2271, 1985. 26 p, 6 fig, 15 tab, 20 ref.

Descriptors: *Pesticide residues, *United States, Path of pollutants, *Water pollution sources, Pesticides in rivers, Water-quality trends, *Monitoring, *Insecticides.

The Pesticide Monitoring Network for rivers was implemented during 1975-80. Water samples were taken four times per year and bed-sediment samples two times per year at 160 to 180 stations located on major rivers of the United States. Samples were analyzed for 18 insecticides and five herbicides, which together accounted for about one-third of the total amount of all pesticides applied to major crops during 1975-80. Less than 10 percent of almost 3,000 water samples and less than 20 percent of almost 1,000 bed-sediment samples contained reportable concentrations of any of the compounds. The patterns of detection result from a combination of widely variable detection capabilities, chemical properties, and use. Most detections in water samples were of relatively persistent yet soluble compounds: atrazine (4.8% of samples), simazine (1.8%), diazinon (1.2%), and lindane (1.1%). Most detections in bed-sediment samples were of the hydrophobic and persistent insecticides: DDE (17%), DDD (12%), dieldrin (12%), chlordane (9.9%), and DDT (8.5%). Only for atrazine in water, and DDE, DDD, DDT, and chlordane in bed sediments, were geographic patterns of detection correlated ($p < or = 0.10$) with their use on farms. Detections of organochlorine insecticides in both water and bed sediments appear to have erratically but gradually decreased during 1975-80. For the 1975-79 period, more stations had downtrends than had uptrends in bed-sediment levels of organochlorines. No clear trends were evident in concentrations of organophosphate insecticides or herbicides in either water or bed sediments. Findings suggest that future pesticide monitoring efforts must be responsive to changes in pesticides used and to geographic patterns of use. Different types of monitoring approaches are necessary for chemicals having different chemical and physical properties. However, before an effective dynamic monitoring effort can be designed, selected case studies are needed to characterize and refine sampling and analytical capabilities for different types of chemicals, river environments, and sample types. (USGS)
W86-02764

RECONNAISSANCE OF TOXIC SUBSTANCES IN THE JORDAN RIVER, SALT LAKE COUNTY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
K. R. Thompson.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4155, 1984. 31 p, 1 fig, 14 tab, 15 ref.

Descriptors: Water quality, *Utah, Great Basin, *Heavy metals, *Pesticide resides, Pollutants, Toxins, Sediments, *Jordan River, Reconnaissance studies, Salt Lake County, Toxic substances.

A reconnaissance of toxic substances in the Jordan River, Salt Lake County, Utah, was made during July, 1980 to October, 1982 as part of a larger study of the river that included studies of sanitary quality, dissolved oxygen, and turbidity. Samples for toxic substances were collected at five sites on the Jordan River, at three major tributaries, and at six storm drains. The toxic substance that most frequently exceeded State standards was total mercury. About 78 percent of the 138 samples for total mercury exceeded the State standard of 0.05 microgram per liter. Other toxic substances that exceeded State standards were: Ammonia-18 percent of the samples analyzed, cadmium--9 percent, copper-9 percent, zinc--6 percent, and lead--2 percent. One sample for cyanide and one for iron also exceeded State standards. The diversity of toxic substances with concentrations large enough to cause them to be problems increased from the upstream sampling site at the Jordan Narrows to the next two downstream sites at 9000 South and 5800 South Streets. Concentrations of trace elements in stream-bottom materials also increased in a downstream direction. Substantial increases first were observed at 5800 South Street, and they were sustained throughout the downstream study area. Iron is transported in the greatest quantity of all the trace elements studied, with a mean load of 110 pounds per day. Notable loads of barium, boron, lead, and zinc also are transported by the river. DDD, DDE, DDT, dieldrin, heptachlor, methoxychlor, PCB, and 2,4-D were detected in bottom materials; and DDE, Silvex, and 2,4-D were detected in water samples. Of 112 organic compounds in the Environmental Protection Agency's priority pollutant list, only chloroform was detected in the storm drains that empty into the Joran River. Several metals and phenol also were detected in the samples for priority pollutants. (USGS)
W86-02766

APPRAISAL OF DATA FOR GROUND-WATER QUALITY IN NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02810

GROUND-WATER CONTAMINATION IN EAST BAY TOWNSHIP, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
F. R. Twenter, T. R. Cummings, and N. G. Grannemann.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4064, 1985. 63 p, 30 fig, 6 tab, 23 ref.

Descriptors: Hydrogeology, Glacial drift, Groundwater, Aquifers, Water supply, *Groundwater movement, Water pollution, *Path of pollutants, Organic compounds, *Groundwater contamination, Chemical analysis, East Bay Township, Grand Traverse County, *Michigan.

Glacial deposits, as much as 360 feet thick, underlie the study area. The upper 29 to 118 feet, a sand and gravel unit, is the aquifer tapped by all wells in the area. This unit is underlain by impermeable clay that is at least 100 feet thick. Ground-water flow is northeastward at an estimated rate of 2 to 5 feet per day. Hydraulic conductivities in the aquifer range from 85 to 250 feet per day; 120 feet per day provided the best match of field data in a ground-water flow model. The depth to water ranged from 1 to 20 feet. Chemical analyses indicate that ground water is contaminated with organic chemicals from near the Hangar/Administration building at the U.S. Coast Guard Air Station at East Bay, about 4,300 feet northeast. The plume, which follows ground-water flow lines, ranges from 180 to 400 feet wide. In the upper reach of the plume, hydrocarbons less dense than water occur at the surface of the water table; they move downward in the aquifer as they move toward east Bay. Maximum concentrations of the major organic compounds include: benzene, 3,390 ug/L; toluene, 55,500 ug/L; xylene, 3,900 ug/L, tetrachloroethylene, 3,410 ug/L; amd bis (2-ethyl hexyl) phthalate, 2,100 ug/L. Soils are generally free of these hydrocarbons; however, in the vicinity of past drum storage, aircraft maintenance operations, and fuel storage and dispensing, as much as 1,100 ug/kg of tetrachloroethylene and 1,500 ug/kg of bis (-ethyl hexyl) phthalate were detected. At a few locations higher molecular weight hydrocarbons, characteristic of petroleum distillates were found. (USGS)
W86-02814

QUALITY OF WATER FROM BEDROCK AQUIFERS IN THE SOUTH CAROLINA PIEDMONT,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02823

RUNOFF AND WATER QUALITY CHARACTERISTICS OF SURFACE-MINED LANDS IN ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02826

GAZETTEER OF SURFACE-MINE LAKES, EASTERN INTERIOR COAL PROVINCE, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
D. C. Voelker.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4355, 1985. 93 p, 19 fig, 2 tab, 11 ref.

Descriptors: Water quality, *Strip mine lakes, *Gazetteer, Water analysis, *Illinois, Area 35, *Pollutant identification.

Hundreds of lakes have been formed as a result of surface mining in Area 35 of the Eastern Interior Coal Province in Illinois. This gazetteer contains physical and chemical data from 107 surface-mine lakes sampled from June through August 1983. Information collected includes location, morphology, and vertical profile measurements of water quality of the lakes. Sampled lakes range in size from 8.8 to 210 acres, and are from 4.0 to 92.0 feet deep. Maximum widths range from 0.03 to 0.35 mile, and maximum lengths range from 0.27 to 3.08 miles. Some lake waters were stratified, whereas others were completely mixed. General water quality differed widely among the lakes. Specific conductances ranged from 130 to 7,800 micromhos per centimeter (at 25 degrees Celsius). Specific conductances of 2,000 to 5,000 micromhos per centimeter were most prevalent. The pH values ranged from 1.8 to 9.6 at the surface, whereas bottom measurements ranged from 2.0 to 8.5. Water temperatures near the surface ranged from 22.5 degrees Celsius in June to 34.5 degrees Celsius in August. Dissolved-oxygen concentrations differed greatly among the lakes; concentrations near the surface ranged from 6.0 to 13.2 milligrams per liter. Transparencies ranged from 0.3 to 35.4 feet. (USGS)
W86-02831

QUALITY OF WATER IN THE ALLUVIAL AQUIFER, AMERICAN BOTTOMS, EAST ST. LOUIS, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
D. C. Voelker.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4180, 1984. 51 p, 14 fig, 5 tab, 17 ref.

Descriptors: *Groundwater, Water quality, Alluvial aquifers, Water analysis, *East St. Louis, Groundwater levels, Groundwater quality, *Illinois, *American Bottoms, Pollutant identification.

Ground-water levels in the American Bottoms regions around East St. Louis, Illinois, have risen several feet since the early 1970's. Artificial dewatering of the aquifer by increased pumping is being investigated by the U.S. Army Corps of Engineers to alleviate economic and health concerns resulting from elevated ground-water levels. A ground-water quality evaluation is necessary for selecting a feasible dewatering scheme. Analyses of water samples from 63 wells show that except for iron, manganese, and dissolved solids, constituent concentrations do not exceed Illinois water-quality standards. The waters are primarily of the calcium-magnesium-bicarbonate type with some calcium-sulfate type water. Iron concentrations ranged from less than 3 to 82,000 micrograms per liter, manganese from 5 to 5,300 micrograms per liter, and dissolved solids from 140 to 3,000 milligrams per liter. These constituent concentrations exceed Illinois' public water supply, effluent, and general water-quality standards in most samples and analysis indicates the concentrations are representative of the ambient water quality. Concentrations of nitrite + nitrate nitrogen fluoride, zinc, lead, and sulfate also exceeded Illinois water-quality standards in a few samples. Concentrations of organic pesticides, polychlorinated biphenyls, and polychlorinated naphthalenes were below analytical detection limits. (USGS)
W86-02832

QUALITY-ASSURANCE DATA FOR ROUTINE WATER ANALYSIS IN THE LABORATORIES OF THE U.S. GEOLOGICAL SURVEY FOR WATER-YEAR 1983,
Geological Survey, Lakewood, CO. Water Resources Div.
D. B. Peart, and N. A. Thomas.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4234, 1984. 112 p, 180 fig, 10 tab, 4 ref.

Descriptors: Alkalinity, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chemical analysis, Chlorides, Chromium, Cobalt, Copper, Dissolved solids, Fluorides, Heavy metals, Iron, Laboratories, Lead, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Nitrates, Nitrites, Nitrogen, Nitrogen compounds, Phosphorus, Potassium, Probability distribution, Quality control, Selenium, Silica, Silver, Sodium, Specific conductivity, Statistics, Strontium, Sulfates, Trace elements, *Water analysis, Zinc, *Data collections, *Water quality, *Quality Assurance data.

The U.S. Geological Survey maintains a quality-assurance program based on the analysis of reference samples for its two water-analysis laboratories located in Atlanta, Georgia, and Denver, Colorado. Reference samples containing selected inorganic constituents are prepared at the U.S. Geological Survey's Ocala, Florida office and disguised as routine samples, and sent daily or weekly, as appropriate, to each laboratory through other U.S. Geological Survey offices. The results are permanently stored in the National Water Data Storage and Retrieval System (WATSTORE), the U.S. Geological Survey's data base for all water data. These data are analyzed statistically for precision, bias, and comparability. The results of these statistical analyses are presented for data collected during the 1983 water year. Nutrient samples, simulated precipitation (low-concentration level) samples and selected pesticide samples were also submitted as samples of unknown concentrations. The results of these determinations were statistically analyzed for comparability and these data are presented. In addition, a summary of recovery and precision data from three different instruments for volatile organics is presented. (USGS)
W86-02834

WATER-QUALITY CHARACTERISTICS FOR SELECTED SITES ON THE CAPE FEAR RIVER, NORTH CAROLINA, 1955-80--VARIABILITY, LOADS, AND TRENDS OF SELECTED CONSTITUENTS,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02848

STATISTICAL SUMMARY OF DAILY VALUES DATA AND TREND ANALYSIS OF DISSOLVED-OXYGEN DATA AT NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN) STATIONS,
Geological Survey, Austin, TX. Water Resources Div.
F. C. Wells, and T. L. Schertz.
Available from OFSS, USGS BOX 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4172, 1983. 526 p, 1 fig, 52 tab, 7 ref.

Descriptors: *Water quality, *Data collections, *Texas, Streamflow, Conductance, Dissolved oxygen, Water temperature, Hydrogen ion concentration.

A statistical summary is provided of the available continuous and once-daily discharge, specific-conductance, dissolved oxygen, water temperature, and pH data collected at NASQAN stations during the 1973-81 water years and documents the period of record on which the statistical calculations were based. In addition, dissolved-solids data are examined by regression analyses to determine the relation between dissolved solids and specific conductance and to determine if long-term trends can be detected in dissolved-solids concentrations. Statistical summaries, regression equations expressing the relation between dissolved solids and specific conductance, and graphical presentations of trend analyses of dissolved solids are presented for 515 NASQAN stations in the United States, Canada, Guam, and Puerto Rico. (USGS)
W86-02873

DESIGN OF A GROUND-WATER QUALITY MONITORING NETWORK FOR THE SALINAS RIVER DRAINAGE BASIN, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02909

5B. Sources Of Pollution

TEMPORAL AND SPATIAL VARIABILITY OF STREAMFLOW ACIDIFICATION IN VERMONT,
Vermont Univ., Burlington. School of Natural Resources.
J. C. Clausen, A. J. Pisanelli, and K. M. Roy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214518/AS, Price codes: A04 in paper copy, A01 in microfiche. Vermont Water Resources Research Center Completion Report, Burlington, August, 1984. 51 p, 7 fig, 5 tab, 50 ref, append. USGS G873-02.

Descriptors: *Water pollution sources, Acidic deposition, *Acid rain, Acid precipitation, Streamflow, Sensitivity criteria, Precipitation monitoring, *Vermont, Forested watersheds.

Twelve streams draining the Green Mountains in Vermont were sampled five times along elevation gradients for pH, alkalinity, and conductance to assess their acidification status. Streamflow and precipitation pH were continuously monitored at one site to characterize rainfall/runoff pH depressions. Streamflow pH, alkalinity, and conductance varied both temporally and spatially. Lower streamflow pH, alkalinity and conductance values occurred during spring runoff and at higher elevations. Streamflow chemistry was related to certain acidic deposition sensitivity criteria, including: elevation, watershed area, surficial geology, and bedrock geology. Weekly precipitation composite pH was not different from mean precipitation pH obtained by continuous monitoring. Episodic drops in streamflow pH were primarily described by peak discharge.
W86-02455

ACID PRECIPITATION: COMPOSITIONAL CHANGES DURING THROUGHFALL; SOIL WATER,
Vermont Univ., Burlington. Dept. of Botany.
R. Klein.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214534/AS, Price codes: A02 in paper copy, A01 in microfiche. Vermont Water Resources Research Center Completion Report, Burlington, December, 1984. 9 p, 38 ref, 2 tab. USGS G873-04.

Descriptors: *Acid rain, *Acidic deposition, Soil water chemistry, Forested watersheds, *Vermont, Metals.

Lysimeters were installed at two soil depths within each of the three major ecosystems on Camels Hump Mountain. Collections were made weekly during the frost free season of 1982 and 1983. Samples were analyzed for pH, conductivity and a broad range of metals, anionic and cationic constituents and for other physical properties. The findings included: (1) Soil solutions obtained from the upper elevations in a northern coniferous forest zone are significantly more acidic than those from the lower elevation hardwood forest zone; (2) Soil solutions for all ecological zones are more acidic in the spring during and shortly after snowmelt than they are later in the frost free season; (3) Aluminum, particularly in soil solutions from the upper elevations, is present in concentrations known to be phytotoxic to seedlings of forest trees and to groundcover plants; (4) Cadmium, Pb and Zn are, in the spring, present in concentrations that are close to being phytotoxic; (5) There are changes in the ratios of divalent cations to specific metals (e.g., Ca + Mg/Al) during the season and as functions of altitude and forest zones; (6) Nitrate concentration in soil water are also elevation and time dependent.
W86-02457

MOBILITY OF SLUDGE-BORNE DICHLOROBENZIDINE IN LAND APPLICATION SYSTEMS,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
S. A. Boyd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214625/AS, Price codes: A03 in paper copy, A01 in microfiche. Michigan Institute of Water Research, E. Lansing, Completion Report, (1984). 24 p, 3 fig, 4 tab, 9 ref. USGS G849-02.

Descriptors: *Hazardous wastes, *Carcinogens, *Dichlorobenzidene, Michigan, *Fate of pollutants, Tracers, Sludge.

Fate of the carcinogens 3,3'-dichlorobenzidine (DCB) in sludge-amended soil was evaluated. C-14 labelled DCB was used as a tracer to examine mineralization, binding, and mobility of DCB present in sludge. DCB was shown to be very persistent in soil and sludge amended soil with < 2% of the added (C-14)DCB evolved as C-14 CO2 during a 26 week incubation. The major fate of DCB appeared to be the formation of bound (non-extractable) residues with soil and sludge organic matter. Mobility of DCB was evaluated using soil columns which were irrigated with 2.54 cm of water per day for 16 weeks. The strong binding of DCB rendered it highly immobile despite being placed in a sandy soil which was irrigated with large amounts of water. However, some finite, albeit small, quantity was leached through the soil profile in what could be described as a 'slow bleed' of DCB and/or a DCB-conjugate.
W86-02466

UNIFIED MASS TRANSPORT MODEL FOR HIGH AND LOW GROUNDWATER DISPERSIVITIES,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
N. D. Katopodes, C-T. Wu, and D. Karamouzis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214633/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, Michigan Institute of Water Research, East Lansing, August 1984. 62 p, 44 fig, 10 ref. USGS G849-03.

Descriptors: *Mathematical models, *Groundwater movement, Contaminants, *Dispersion, Finite elements, Groundwater, *Mass transport, Numerical methods, Seepage, Michigan.

Mass transport in groundwater is a phenomenon whose physics vary dramatically depending on the magnitude of the dispersion coefficients. At high dispersivities, the dominant transport mechanism is dispersion, which is effectively simulated by means of classical finite element techniques, which have also become the most popular means for computing the flow of groundwater. Therefore the same discretization and field parameters can be used for the simulation of contaminant transport, and the local seepage velocity and saturated thickness can be directly used as input to the transport phase of the modeling process. On the other hand, when the dispersion coefficients are small, convection becomes the dominant factor in the transport of contaminants and the finite element solution becomes unstable. Several remedies have been proposed for the resolution of this difficulty, but most of them require special algorithms for convection-dominated flows, which is almost equivalent to a priori knowledge of the flow conditions and thus limits the predictive ability of the model. In this report certain variances of the classical finite element method are presented, which permit optimum simulation of contaminant transport for both dispersion and convection-dominated flow conditions. These are based on so-called Petrov-Galerkin and Taylor-Galerkin schemes that automatically adjust to the flow conditions and thus unify the simulation of extreme physical conditions in a single computer model. Several tests for verification of the proposed model's validity are presented, followed by description of some novel features of the computer code for accurate and efficient application to practical problems.
W86-02467

EFFECTS OF GRAVEL EXTRACTION ON THE MEADE RIVER AT ATQASUK, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. M. Schell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214724/AS, Price codes: A03 in paper copy, A01 in microfiche. Completion Report 184-14, March, 1984. 26 p, 3 fig, 7 ref. USGS G827-02.

Descriptors: *Water quality, *Turbidity, Water chemistry, *Oxygen content, *Dredging, *Fisheries, Carbon: Nitrogen ratios, *Alaska, Suspended sediments.

The water quality impacts resulting from dredging gravel in the Meade River at Atqasuk, Alaska, (170 degrees W, 70 degrees 28'N) have been studied in the context of fishery resources, principally least cisco, broad whitefish and chum salmon used by local Inupiat residents. Gravel was removed during the summer ice-free months and conveyed via pipeline to an on-land storage site. Runoff from the storage pile was returned to the Meade River with the accompanying fine inorganic particulate matter and organic detritus at loadings up to 10,000 mg/l. The major immediate effects on the receiving waters were to increase turbidity and suspended sediment loads near Atqasuk and downstream as far as 60 km. Inorganic sediments settled out faster than the organic peat detritus and the ratio of organic/inorganic matter increased with distance downstream. Carbon/nitrogen ratios in the organic fraction were constant with time and distance indicating low biological activity in the peat particles. Fisheries impacts are being described separately by the biological investigators. Oxygen demand by microbial consumption of organic matter during winter months was assessed through measurement of concentrations of dissolved oxygen in underice waters in the river channels in spring 1984. Oxygen concentrations were similar to samples taken in the previous winter indicating that respiration rates were very low. Biological studies on fish populations and migrations are continuing.
W86-02475

ACID PRECIPITATION: SOURCE IDENTIFICATION AND ITS EFFECTS ON WATER QUALITY,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
C. P. C. Poon, T. Wright, and M. North.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214880/AS, Price codes: A05 in paper copy, A01 in microfiche. Rhode Island Water Resources Research Center, Kingston, Completion Report No 3 Sept 1984, 86 p, 17 fig, 13 tab, 24 ref. USGS G867-04.

Descriptors: *Rhode Island, *Acid rain, Meteorological data collection, Tracking techniques, Watersheds, Acidity, Alkalinity, Flow, Deposition, Land use, Hydrogen ion concentration.

Three small watersheds in the rural area of R.I. were studied for the effects of acid precipitation on the water quality. All three rivers namely, Wood, Beaver, and Usquepaug, have Class A high water quality with very low alkalinity. Storm tracks were identified by using sequential meteorological maps including satellite photos, radar precipitation scans, and pressure maps. Precipitation samples were titrated and their acid components were quantified by the Gran Plot technique. Storms from the west and southwest direction usually carry more acids than those from west-northwest and south-southwest. All storms have similar effects on the three rivers with the chemistry change more pronounced for the Beaver river because of its smallest size. A large storm or a small storm but with high acid concentrations often reduced the alkalinity of the river water to less than 1.0 mg/l. On extreme cases the alkalinity was reduced to zero and the acidity was increased by 11 folds. As much as 1/2 pH unit drop in the river water could occur in 1/2-day but it would take as long as 5 days to achieve complete recovery. Other than storm direction and storm size, other factors that changed river water chemistry included dry deposition between storms, river flow prior to storm and land use pattern.
W86-02491

NUMERICAL SOLUTION OF TWO-DIMENSIONAL TRANSVERSE DIFFISION EQUATION,
Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
P. Srinivasan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215002/AS, Price codes: A08 in paper copy, A01 in microfiche. December 1981. Thesis Submitted as Requirement for Degree of Master of Science. 147 p, 19 fig, 32 tab, 5 app, 27 ref. B-069-IA.

Descriptors: *Fate of pollutant, *Diffusion coefficient, *Model studies, Iowa, Mathematical models, Finite difference methods, Mixing, Dye concentrations, *Missouri River, Streams.

A solution of the equations governing the mixing of toxic substances in natural streams is presented. The two-dimensional convection-diffusion equa-

tion in a curvilinear coordinate system uses normalized cumulative discharge as an independent variable. The two-dimensional transverse diffusion equation used in the model, and the method of estimation of transverse diffusion are described and discussed. A finite-difference scheme was formulated to solve the convection-diffusion equation using the alternating-direct implicit method. Model tests using an analytical solution developed for a steady state condition are presented. The model was verified with data from a field test conducted in a 27-mile reach of the Missouri River, using dye injected into the circulating system of a powerplant. Predicted values and observed values were in good agreement.
W86-02503

ROLE OF NITRIFICATION IN CONTRIBUTING TO LOW OXYGEN CONDITIONS IN AN URBAN WATERWAY,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
S. W. Nixon, and V. M. Berounsky.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215051/AS, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, Rhode Island Water Resources Center, Kingston, 1984. 49 p, 12 fig, 6 tab, 50 ref. USGS G867-06.

Descriptors: *Nitrification, *Providence River, *Rhode Island, Oxygen demand, Nitrogen compounds, Ammonia, Nitrate, Nitrite, Isotope studies, Water quality waterways.

Rates of nitrification were measured with 15 N tracer methods in the Providence River (R.I.) an urban river with high (over 1200 mmol + 3 ammonium ion/cubic m/3 r ammonia inputs. The rates found for fall and winter were lower than expected, 0.0099 - 0.0404 micromol liter d. Rates of nitrification calculated for ammonia-enriched Narragansett Bay mescosms were an order of magnitude higher at the same concentrations of ammonium ion as the river samples. Possible reasons for the low rates are: a lag period of little or low nitrification activity, delayed recovery of upper water nitrifiers from light inhibition, low concentrations of nitrifying bacteria or, most likely, a substance within the river is inhibiting nitrification. Phytoplankton uptake rates of both ammonium nitrate were measured by 15N, and rates were similar to those found in other studies. Spring rates were higher than fall, winter were lowest. There was little uptake of nitrate. The measured nitrification rates indicate an annual nitrogenous oxygen demand to the river comparable to only about 1% of the annual carbonaceous oxygen demand of the river, suggesting that nitrification is not consuming a significant amount of oxygen in the Providence River.
W86-02508

ACID PRECIPITATION IN THE WASHINGTON CASCADES, PHASE II,
Central Washington Univ., Ellensburg. Dept. of Chemistry.
C. Duncan, and W. Ausserer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215101/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, Washington Water Resources Research Institute, Pullman, Sept 1984. 37 p, 9 fig, 12 tab, 19 ref. USGS G876-03.

Descriptors: *Acid rain, *Lake acidification, Lake susceptibility, Rain composition, Water chemistry, *Acid precipitation, Water pollution sources, *Washington, Cascade Range.

Bulk precipitation was monitored at three sampling stations spanning the Washington Cascades over the Stevens Pass highway route and at one location in the Snoqualmie Pass area over the period November, 1983, to May 1984. The volume weighted average pH over the collection period at Stevens Pass was 5.19. During the periods of simultaneous collection, the pH levels of the Stevens Pass site were higher than those of the Snoqualmie Pass samples. The nitrate to sulfate equivalent ratio at the Stevens Pass site was .61. Based on winter collection, a minimum sulfate deposition is estimated to be 5.8 kg Ha/sq m at Stevens vs. 9.2 kg Ha/sq m at Snoqualmie Pass for 1984. The strong acid content of the samples was observed to increase with the onset of spring. During the summer of 1983, 30 watershed source lakes lying in the Cascades at locations north of Stevens Pass were sampled. All lakes were found to be susceptible, but not acid, with alkalinatives ranging from 39 to 220 uN. Two lakes in the southern portion of the Alpine Lakes Wilderness Area were found to be almost devoid of alkalinity (ANC Av = 3.1 uN) with corresponding low pH levels (Av = 5.8). Overall, the composition of the lake waters (in terms of acid neutralizing capacity relative to calcium, magnesium, sodium, and potassium concentrations) indicated that no significant acidification of the waters has taken place.
W86-02513

KINETIC STUDY OF THE EFFECTS OF ACID RAIN ON TRACE METAL UPTAKE,
Maine Univ. at Orono. Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W86-02517

HYDROGEOLOGY AND PROCESSES OF ACID NEUTRALIZATION IN CADWELL CREEK WATERSHED, QUABBIN RESERVATION, MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
W. C. Leonard, R. F. Yuretich, and S. J. Pohanka.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216893/AS, Price codes: A07 in paper copy, A01 in microfiche. Technical Completion Report, Massachusetts Water Resources Research Center, Publication N. 148, Amherst, December 1984. 131 p, 46 fig, 10 tab, 39 ref. USGS G-848/02.

Descriptors: *Acid rain, *Acid streams, *Acidic soils, *Acidic water, *Acidity, *Alkalinity, *Massachusetts, Quabbin Reservior, Groundwater storage, Groundwater runoff, Hydraulic gradient, Hydrology, Geohydrology, Geochemistry, Geology, Streamflow, Evapotranspiration, Drinking water, Reservoir operation, Massachusetts.

A detailed hydrogeological and geochemical study was undertaken of Cadwell Creek, a small (7.28km2) forested watershed on the west side of Quabbin Reservoir in central Massachusetts. Paleozoic crystalling metamorphic rocks comprise the bedrock in the watershed and are the source material for the glacial till, the main aquifer. During 1983 41% of incoming precipitation was returned to the atmosphere as evapotranspiration and 55% left the watershed as stream runoff. Furthermore, 45% of this stream runoff was groundwater discharge or base flow. Specific conductivity and pH, both field and aerated, showed strong correlations with the groundwater velocity and hydraulic gradient, showed strong correlations with the groundwater velocity and hydraulic gradient. The pH ranged from 4.7 to 7.0 and the specific conductivity from 25 to 70 micromhos/cm. Significant correlations of silica with alkalinity and cations, coupled with a dearth of exchangeable base cations in the watershed soild, indicate that silica weathering is the major control on groundwater composition. Two-thirds of the total base flow comes from areas with low pH and low specific conductivity, i.e. is incompletely neutralized. Also, since baseflow contributes only 45% of the stream runoff, the water leaving the watershed is incompletely neutralized and sensitive to further acidification. However, because of unusual hydrologic and topographic relationships, Cadwell Creek alone should not be used as a standard for all streams draining into Quabbin Reservoir.
W86-02520

EFFECTS OF LAND USE PRACTICES ON WATER RESOURCES IN VIRGINIA,
George Mason Univ., Fairfax, VA. Dept. of Biology.
For primary bibliographic entry see Field 5G.
W86-02523

CHARACTERIZATION OF ACID RAIN PHENOMENA, ATLANTA, GEORGIA,
Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.
C. Beck, and J. Demere.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216943/AS, Price codes: A04 in paper copy, A01 in microfiche. Environmental Resources Center Report No. ERC 04-84, Georgia Institute of Technology, Atlanta, July, 1984, 46 p, 1 tab, 32 ref. G-836(03).

Descriptors: *Acid rain, *Georgia, Water pollution sources, Rain monitoring, Urban site, Subevent sampling, Seasonal variations, Regolith effects, Path of pollutants, Atlanta.

Rain collection and chemical analysis for pH, Na, K, Mg, Ca, NH4, Cl, NO3 and SO4 was initiated at an urban Atlanta site in August 1983 and is continuing on an event and subevent basis. Additional collecting began at Suburban Stone Mountain in June 1984. Current data do not indicate significant urban-suburban-rural differences in composition for the species studied. Subepisode sampling indicates minor and irregular changes in composition during frontal system rains, but during local rains, particularly intense events following extended dry periods during late spring and summer, there are marked decreases with time in the concentrations of all species except H+. Yearly cycles involving summer concentration maxima, in part correlated with summer thunderstorms, are noted for H+, NH4, NO3 and SO4 and possible K and Ca. Stream observations at Stone Mountain provide no evidence for major early regolith modification of rain, other than SO4 removal, but evaporation in a complex path from rock outcrop to stream and possible stream pollution complicate interpretation.
W86-02525

FACTORS INFLUENCING, INFILTRATION, FLOW, INSTABILITY, AND MOVEMENT OF TOXICS IN LAYERED FIELD SOILS,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.
T. S. Steenhuis, and R. J. Glass.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216968/AS, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, August 1984. 45 p, 5 fig, 4 tab, 31 ref. USGS G859-03.

Descriptors: *Infiltration, *Soil water movement, *Path of pollutants, *New York, Wetting front instability, Solute movement.

Application of solute transport theory based on homogeneous laboratory soil column experiments to field situations has been less than successful. Two mechanisms responsible for the discrepancy involve movement through macropores and flow instability or fingering. The latter is observed in soils where the top layer has a lower conductivity than the subsoil. The research presented in the report focuses on a description of unstable wetting fronts in the laboratory and for field soils. The main findings were that high initial moisture contents, while having a stabilizing effect when uniformly distributed, allow instability to occur when distributed heterogeneously by an earlier unstable infiltration flow; that unstable flow fields, once established, change very little in time even over relatively long lengths of time; and that unstable flow fields and properties may be systematically and quantitatively explored through controlled laboratory experimentations. The results of the study have implications for monitoring systems and groundwater pollution prediction models applied to field soils where instability occurs.
W86-02527

DIAGNOSING THE CAUSES OF GROUNDWATER CONTAMINATION USING A MATHEMATICAL MODEL,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
S. Pacenka.

Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217008/AS, Price codes: A03 in paper copy, A01 in microfiche. Technology Transfer Project Completion Report, Sept 1984. 12 p, 2 tab, 3 fig, 6 ref, 2 append. USGS G859-23.

Descriptors: *Technology transfer, *Training, *Groundwater pollution, *New York, Mathematical models, Water pollution sources, Path of pollutants.

Ground-water contamination cases are now being detected at a rate faster than the capability of regulatory agencies to diagnose and solve them. Automation, in the form of low-cost microcomputers and simple mathematical models of contaminant behavior, can help to gain control of the growing backlog of cases. These tools can amplify the skills of the limited number of specialists in this area now employed by the key agencies such as state-level environmental and health departments. Since the same tools can also be used in advance planning for the prevention of ground-water contamination, they could also help to foster the transition from the current, crisis-driven system to one which detects potential problems early and eventually prevents them before they start. The report describes a technology transfer workshop which employed microcomputers and associated software in training agency specialists about the movement and fate of groundwater contaminants.
W86-02531

STUDY AND PREDICTION OF BACTERIAL AND VIRAL CONTAMINATION OF GROUNDWATER FROM LANDFILLS AND SEPTIC TANK SYSTEMS,
Delaware Univ., Newark. Dept. of Civil Engineering.
M. Y. Corapcioglu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217701/AS, Price codes: A04 in paper copy, A01 in microfiche. Delaware Water Resources Research Center, Newark, Project Completion Report, 1984. 55 p, 18 fig, 3 tab, 44 ref. USGS G833/02.

Descriptors: *Groundwater pollution, Sanitary landfills, Septic wastewater, Path of pollutants, *Soil disposal fields.

To serve as a tool in the long term evaluation of the risk of accumulation of microbial contaminants (bacteria and viruses) entering soil and groundwater, a mathematical model is developed to predict the spatial and temporal distribution of pollutant concentration. The governing equation for bacterial transport is coupled with another transport equation for the bacterial nutrient present in the seeping wastewater. The deposition and declogging mechanisms are incorporated into the model as a rate process for bacteria and as an equilibrium partitioning for viruses. While the decay is assumed to be a first order reaction and the growth of bacteria is assumed to follow the Monod equation, the model equations exhibit nonlinearity and coupling. A simplified set of equations is solved analytically to test the numerical results. Coupled numerical solutions in one and two dimensions are obtained by the Galerkin method at spatial and temporal locations of interest. Cases studied include a soil column and a horizontal two-dimensional field coupled with the one dimensional solution. It has been found that the bacteria is removed almost totally within the top 7 cm of soil with minimal risk of clogging.
W86-02535

SINGLE-WELL, MULTIPLE-PULSE TRACER TECHNIQUE FOR ESTIMATING GROUND WATER VELOCITIES AND POLLUANT TRANSPORT RATES: THEORETICAL DEVELOPMENT,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
P. G. Kaplan, and D. I. Leap.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225845/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. 167, August, 1984. 27 p, 8 fig, 14 ref. USGS G841-02.

Descriptors: *Groundwater movement, *Groundwater pollution, *Tracers, wells, Path of pollutants, Pulse testing(wells), Test wells, *Indiana.

Two new methods have been developed to provide velocity estimations that should be superior to standard single-well, point dilution drift tests or to single-well injection tests because the new methods determine velocity over a larger distance from the well than is possible with the standard methods, and the tracer pulses utilized in the new methods are narrow enough that their behavior approaches that of a point in a flow field. Both methods utilize the superposition of radial, well-flow velocity and linear, regional ground-water velocity. Neither of the theories has been tested experimentally or in a field setting. Plans exist for laboratory testing of both using scale models of aquifers. The first method requires prior knowledge of the product of effective porosity and aquifer thickness. Three pulses are allowed to drift into the aquifer and are then pumped back. Variations in retrieved pulse spacing are used to estimate drift distance and regional velocity. The second method does not require prior knowledge of the porosity-thickness product and utilizes only two pulses. The two identical, square-wave pulses are injected into the aquifer in very thin streams and flushes in with water. The pulses are then immediately pumped back. Variations in time spacings between the injected and retrieved pulses can then be used to estimate pulse travel distance and regional velocity.
W86-02560

INFLUENCE OF NITROGEN APPLICATION AND IRRIGATION ON GROUND-WATER QUALITY IN THE COASTAL PLAIN,
Delaware Univ., Newark. Dept. of Agricultural Engineering.
W. F. Ritter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225852/AS, Price codes: A03 in paper copy, A01 in microfiche. Delaware Water Resources Research Center, Newark, Project Completion Report, 1984. 22 p, 7 tab, 20 ref. USGS G833/06.

Descriptors: Groundwater, *Nitrates, Irrigation, New Jersey, Leaching, *Return flow, *Groundwater pollution.

Soil samples were taken on 16 irrigated fields and one forested site to evaluate nitrogen leaching. Corn was grown on all but one of the fields for at least 3 out of the last 4 years. Soil samples were also taken from irrigated corn plots where poultry manure and ammonium nitrate fertilizer were applied at a rate of 202 kg/ha. Nitrate concentrations were lower on the forested site and a field where soybeans were grown for 4 years than on the other sites. Nitrate leaching was occurring on some of the fields in both irrigated and non-irrigated areas. Nitrate concentrations at different depths were not related to soil type.
W86-02561

LATERAL MOISTURE MOVEMENTS IN UNSATURATED ANISOTROPIC MEDIA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 2G.
W86-02562

GROUNDWATER PROBLEMS IN THE MID-ATLANTIC FALL-LINE CITIES,
District of Columbia Univ., Washington. Water Resources Research Center.
For primary bibliographic entry see Field 2F.
W86-02574

DEVELOPMENT OF FREQUENCY FUNCTIONS FOR URBAN NON-POINT SOURCE RISK EVALUATION,
Catholic Univ. of America, Washington, DC. Dept. of Civil Engineering.
G. K. Young, and E. Neal.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225993/AS, Price codes: A06 in paper copy, A01 in microfiche. D.C. Water Resources Research Center, Washington, District of Columbia, Report No. 59, September 1984. 88 p, 9 fig, 8 tab, 16 ref, 10 append. USGS G834-04.

Descriptors: *Urban hydrology, *Washington(DC), *Water pollution sources, Calibration, Microcomputers, Runoff, Verification, Watershed Data, Water quality, *Mathematical models, Rainfall-runoff relationships, Computer programs.

A microcomputer-based daily accounting model of runoff and pollutant emission from an urban catchment has been developed. The model has been calibrated and verified by application to D.C. area watershed data. The results from the investigation indicate that the model is accurate and reliable. The model is easily implemented on a microcomputer and thus avoids the extensive time and costs associated with modeling urban water quality on mainframe computers, using existing complex simulation models.
W86-02575

ORGANIC CONTAMINANT TRANSPORT IN GROUNDWATER, SURFACE WATER, AND SURFACE WATER SEDIMENTS. YEAR 1 PROGRESS REPORT,
Wyoming Univ., Laramie. Coll. of Arts and Sciences.
M. J. Crossey, and H. L. Bergman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-226322/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, Wyoming,Water Research Center, Laramie, September 1984. 33 p, 4 fig, 1 tab, 19 ref. USGS G879-03.

Descriptors: *Wyoming, *Path of pollutants, *Surface waters, *Groundwater, Water quality, Surface-groundwater relations, Organic compounds, Contamination, Oil wastes, Water pollution sources, *Groundwater pollution, *Laramie River.

Questions concerning the transport and fate of contaminants in the environment have typically been limited to single compounds. Hazardous waste disposal facilities, chemical plants, oil refineries, etc., however, typically produce complex waste streams which may contact groundwater or surface waters. This study gives results on movement through ground and surface water of a complex mixture of organic compounds emanating from a wood-treatment facility located adjacent to the Laramie River in Laramie, Wyoming. A conceptual model summarizing laboratory and site observations shows: (1) subsurface transport of contaminants in oil, oil/water emulsions, and groundwater; and (2) riverine transport of contaminants in water, sorbed to sediments, and as oil globules. Experiments with glass column packed with a uniform material (1 mm glass beads, sand or gravel) indicates that in even the most homogenous, isotropic matrix, oil/water mixtures cannot be expected to flow in a uniform manner. Creosote sludges and oils break up into globules and stringers with no uniform front of contamination. Data from a field study using mini-piezometers in the Laramie River adjacent to the site confirm this observation. Chemical analysis of sediments and fish, as well as field observations indicating oily droplets moving along the river bed, clearly establish contamination of the Laramie River resulting from offsite migration of creosote from the wood treating facility.
W86-02579

EVALUATION OF SURFACE WATER RUNOFF FROM SWINE FACILITIES FOR CONTAMINATION WITH VIRUSES,
Nebraska Univ.-Lincoln. Dept. of Veterinary Science.
C. Kelling, and M. L. Frey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227197/AS, Price codes: A02 in paper copy, A01 in micro-

fiche. Project Completion Report, Nebraska Water Resources Center, Lincoln, August 1984. 9 p, 1 fig, 2 tab. G854-04. 14-08-0001-G854.

Descriptors: *Water pollution sources, *Nebraska, Water quality, Surface water, Runoff, *Viruses, Water pollution, Contamination, *Farm wastes, Pseudorabies virus.

Molecular filtration was used to concentrate pseudorabies virus (PRV; Herpesvirus suis) from 6 liters of non-sterile water containing particulate matter from a natural source (creek or lake water) in which a known quantity of PRV was added. The molecular filtration technique used proved to have an average 63% recovery rate. Two surface water runoff samples were collected from each of 10 Nebraska swine farms where pseudorabies (PRV) virus infection and clinical disease had been diagnosed, and later confirmed by virus isolation or immunofluorescence. Each of the 20 samples were sonicated, clarified by low speed centrifugation and concentrated using the molecular filtration system. Aliquots of the concentrates were used to inoculate cell cultures for virus isolation. Other aliquots were further concentrated by high speed centrifugation and used to prepare grids for electron microscopic visualization. Pseudorabies virus and other viruses were not isolated from the runoff samples using cell cultures or observed by electronmicroscopy. Occasional unidentified single virions were seen by the latter procedure.
W86-02584

ALDICARB STUDIES IN GROUNDWATERS FROM CITRUS GROVES IN INDIAN RIVER COUNTY, FLORIDA,
Florida Inst. of Tech., Melbourne. Dept. of Environmental Sciences and Engineering.
F. E. Dierberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227239/AS, Price codes: A05 in paper copy, A01 in microfiche. Florida Water Resources Research Center, Gainesville, Publication No. 76, June 1984. 77 p, 5 fig, 9 tab, 37 ref, 3 append. USGS G835-03.

Descriptors: *Pesticide kinetics, Degradation, Persistence, Soil profile, *Groundwater, Citrus, *Florida, *Fate of pollutants, Groundwater pollution.

The disappearance of aldicarb (2-methyl-2(methylthio) propionaldehyde 0-(methylcarbamoyl) oxime) and its two toxic degradation products, aldicarb sulfoxide and aldicarb sulfone, were measured in laboratory studies using groundwaters and subsoils collected from citrus groves in Indian River County, Florida, and incubated under controlled conditions which best represented the in situ environment. The half-life times for total residue disappearance in groundwater-saturated subsoils ranged from 10-26 days, suggesting a resumption to the reported faster aerobic degradation rates in the upper soil layers after having undergone slow degradation in unsaturated subsoils. Based on the degradation rates found in this study, hydrologic parameters obtained for Indian River County subsoils, and amounts of total toxic residue reported entering Florida groundwaters, it was estimated that toxic residues in aldicarb-contaminated groundwaters in Indian River County would migrate only short distances (1-17 ft) before conversion of toxic residues to non-toxic residues was completed. Based on hydrolysis experiments in sterile pH-buffered distilled water for aldicarb, hydrolysis rate constants became second-order (kOH = 1.94 x 10 to the third L mole minus 1 day minus 1 at 20 degrees C) at pH 8 and above; acid-catalyzed hydrolysis occurred at pH 4, but not to the same extent as base-catalyzed hydrolysis.
W86-02588

ANALYSIS OF INJECTION IN STRATIFIED AQUIFERS,
Florida Univ., Gainesville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W86-02589

CHANGES IN DISTRIBUTION OF MINERAL NITROGEN UNDER NATIVE RANGE AND CULTIVATED FIELDS AT THE NEBRASKA SANDHILLS AG. LABORATORY,
Nebraska Univ., North Platte. Dept. of Agronomy.
G. L. Hergert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227254/AS, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, Nebraska Water Resources Center, Lincoln, September 1984. 29 p, 11 fig, 5 tab, 8 ref. USGS G854-05. 14-08-0001-G854.

Descriptors: *Nitrate, *Leaching, Movement, *Nebraska, Water management, Irrigation practices, Unsaturated zone, Nitrogen fertilizer management.

The objectives of this project were to: (1) determine the distribution of nitrate-N, ammonium-N and Cl from the soil surface to the water table under cultivated irrigated fields and adjacent native range sites at the UNL Sandhills Ag. Laboratory; and (2) compare this information with nutrient profiles taken during 1980 and 1981 to determine downward movement of the nitrate to the water table. Substantial textural differences occurred with small depth increments at these sites. Textural changes caused increased water content at coarse/fine boundaries and produced higher nitrate content showing an ion sieving effect. The data shows significant enrichment of nitrate-N to a depth of 70 feet under irrigated corn as compared with adjacent native range. Analysis of past data and this sampling indicate an average downward movement of nitrate lost by leaching of 7 feet/year under the cultivated area. Ammonium enrichment of the soil under the irrigated corn compared to the native range was also discerned to a 50-foot depth. Previous samplings indicated little difference in ammonium distributions between sites. A simplistic vadose zone nitrogen budget indicated average annual nitrate-N losses of 50 to 70 lbs/N/A/year. The data do not unequivocally answer the questions of whether some nitrate has been dentrified or has already reached the water table at 100 feet.
W86-02590

IMPLICATION OF TEMPORAL VARIATIONS AND VERTICAL STRATIFICATION OF GROUNDWATER NITRATE-NITROGEN IN THE HALL COUNTY SPECIAL USE AREA,
Nebraska Univ.-Lincoln. Conservation and Survey Div.
M. E. Spalding.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227262/AS, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, Nebraska Water Resources Center, Lincoln, September 1984. 44 p, 9 fig, 3 tab, 13 ref. USGS G854-06. 14-08-0001-G854.

Descriptors: *Nebraska, Groundwater, Water quality, *Stratification, *Temporal distribution, Spatial distribution, *Nitrates, *Nitrogen.

Vertical distribution and temporal variations in NO3-N concentrations and water level measurements during 1980 and 1981 were interpreted to ascertain the feasibility of developing a solute transport model between the study area, which is underlain by a large zone of NO3-N contaminated groundwater, and Grand Island, NE. NO3-N concentrations in shallow groundwater downgradient from irrigated fields were high and reflect site specific anthropogenic inputs. The large temporal variations and their unpredictability are caused by fluxes of NO3-N carried by infiltrating precipitation and irrigation return flows. There is a decrease in NO3-N levels with depth in the aquifer with the sharpest decrease occurring in the upper half. Concentrations at mid-depth and near the bottom of the aquifer are much lower and less variable than in the shallow groundwater. This homogeneity results from slow vertical movement. Near the eastern edge of the study area, there is a sharp decline in the areal concentrations of NO3-N and a markedly different vertical profile. These changes coincide with the location of a recently delineated NO3-N redox front where NO3 is being actively removed from the groundwater. Thus, the discovery of the non-conservative nature of NO3 within the study area invalidates the predictive usage of classical solute transport models.
W86-02591

ORGANIC GROUNDWATER CONTAMINATION EVALUATION AND PREDICTION,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
J. T. O'Connor, M. M. Ghosh, and S. K. Banerji.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-230068/AS, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, September 1984. 69 p, 15 tab, 59 ref. USGS G-852-05. 14-08-0001-G-852.

Descriptors: *Path of pollutants, *Soil water, Organic compounds, Groundwater pollution, Soil adsorption capacity, Groundwater movement.

Adsorption of two organic compounds, Trichloroethylene (TCE) and Pentachlorophenol (PCP), on several Missouri soils were determined. The soils used were: Coppock, Parsons, Putnam, Grundy and Lebanon Series. TCE concentrations were determined by gas chromatography, while PCP determinations were made by radio-assay technique. Batch adsorption experiments were conducted using a soil and different concentrations of the organic compound. It was found that the adsorption data for both TECE and PCP followed Freundlich relationship. TCE and PCP adsorption on Missouri soils decreased with increasing pH. Organic matter in soil was an important parameter in determining the PCP adsorption was somewhat high. This would indicate that TCE would migrate readily with groundwater while PCP migration would be somewhat retarded.
W86-02614

EFFECTS OF U.S. ANTIMONY'S DISPOSAL PONDS ON ALLUVIAL AQUIFER AND PROSPECT CREEK, WESTERN MONTANA,
Montana Univ., Missoula. Dept. of Geology.
W. W. Woessner, and M. Shapely.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-230100/AS, Price codes: A05 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Bozeman Completion Report No. 145, 1985. 81 p, 27 fig, 5 tab, 25 ref. USGS G853-03. 14-08-0001-G853.

Descriptors: Mining, *Heavy metals, Groundwater, Surface water, *Water pollution sources, Groundwater movement, Arsenic waste, Lysimeters, Leachate, Alluvial aquifers, *Tailings ponds, U.S. Antimony, *Montana, Prospect Creek.

The study investigated the effects of a 10 acre impoundment, storing antimony milling and processing waste, on the alluvial groundwater and stream system of a mountain drainage in western Montana. The ponds were instrumented with nine suction lysimeters and the adjacent groundwater system with seven shallow monitoring wells. The associated valley surface water systems were also gaged and sampled for water chemistry. Water quality samples, head measurements and stream discharge gaging were scheduled to record data from the widest possible range of hydrologic conditions. Concentrations of dissolved AS and Sb were found to range from 6.3 to 410.0 mg/l and 4.7 to 100.0 mg/l, respectively, in the sodium sulfate dominated pond fluids. Recharge of the underlying groundwater system occurs principally by seepage from the pond bottom and unsaturated flow in the vadose zone beneath the ponds. Rapid rises of up to 1.7 feet per day of the underlying groundwater system occur in response to large quantities of recharge from adjacent losing reaches of Prospect Creek and Cox Gulch. Pond fluids in the vadose zone are entrained in groundwater during periods of water table rise and carried down gradient east of the ponds. Antimony concentrations in the groundwater down gradient from the pond range up to 1.9 mg/l. Arsenic concentrations never exceed 0.033 mg/l. Sulfate, sodium and antimony from the waste disposal ponds measurably degrade surface water and groundwater for at least three and one half miles downstream from the site.

W86-02618

VERIFICATION OF SHORELINE SEWAGE LEACHATES IN FLATHEAD LAKE, MONTANA,
Montana Univ., Bigfork. Biological Station.
J. A. Stanford, and J. H. Jourdonnais.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-230118/AS, Price codes: A03 in paper copy, A01 in microfiche. Montana Water Resources Research Center Bozeman completion report no. 148, Bozeman, February, 1985. 38 p, 7 fig, 13 tab, 11 ref. USGS G853-04. 14-08-0001-G853.

Descriptors: Fluorometry, Florescence, *Sewage leachates, Lake shores, Detergents, Algae, Groundwater, Septic tanks, Soil disposal fields, Organic compounds, Conductivity, *Montana, *Flathead Lake, *Water pollution sources, *Nutrients.

Field measurements of fluorescence and conductivity were used to locate seeps entering littoral areas of Flathead Lake. Seeps contaminated by sewage leachates generally produced significantly greater fluorescence than would be expected from the presence of naturally occurring humic substances. High fluorescence result from whiteners, which are detergent additives, apparently leached from faulty drainfields near the lakeshore. Seeps were designated as contaminated by sewage leachates if the ratio of fluorescence; dissolved organic carbon exceeded 380. Accuracy of this index was established by fluorescence patterns from emmission scans specific to whiteners in seep water. Although mats of algae characterized littoral areas receiving nutrient laden groundwater, no relationship was found between the degree of contamination of algae species composition or biomass. Natural, unpolluted groundwaters contained sufficient nutrients to promote algae mats. Based on these, stepwise procedures for in situ surveys were developed to quantify sewage contamination from shoreline septic systems in lakes.
W86-02619

UNCERTAINTY IN MODERN IMPOUNDMENT MODELS: EFFECTS AND METHODS OF ANALYSIS,
Nevada Univ. System, Las Vegas. Water Resources Center.
R. H. French, and F. L. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232783/AS, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, Publication 41097, 1984. 33 p, 2 tab, 7 ref, 4 append. USGS G855-04. 14-08-0001-G-855.

Descriptors: Modeling, *Reservoir models, Water quality models, Dynamic models, *Coefficient variability.

Behavior of a system in a dynamic impoundment model is described by a set of simultaneous partial differential equations. Accuracy and validity of the model is dependent upon coefficients utilized in the model. It has been noted that a clever modeler can achieve any desired results by careful adjustment of the coefficients. Further, there is no guarantee that the coefficients chosen are unique to a given solution. A more rational approach is to include, explicitly in the model, the variability of the coefficient values. Review of the literature indicates that previous investigators have addressed the problems of coefficient variability and uncertainty in a number of ways. In semi-empirical models standard and rather simple statistical concepts are used. A second and probably the most popular method is use of Monte Carlo simulation. Other methods include propagation of variance and treatment of the equations in the model as random differential equations. At the present time only one commonly available dynamic impoundment water quality model, CE-QUAL-RI, has the capability of taking coefficient uncertainty into account. Other techniques may yield more cost-effective results in terms of modeling simplicity and computer utilization.
W86-02623

CHEMICAL CONSTITUTENTS OF RAINFALL AT DIFFERENT LOCATIONS ON OAHU, HAWAII,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
G. L. Dugan, and P. C. Ekern.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232866/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Report 160, Honolulu, May, 1984. 25 p, 7 tab, 4 fig. USGS G838-03. 14-08-0001-G838.

Descriptors: *Acid rain, *Chemistry of precipitation, *Nitrogen compounds, Organic nitrogen, Sulfur cycle, Tropic Zone, *Hawaii, *El Chichon, *Kilauea Volcano, Oahu, Hawaii Island.

Rainfall sampling, which began in 1981 before the 1982 to 1983 El Nino and continued into 1984 on Oahu in Hawaii, represented sites with widely different rainfall amounts. Samples stored under refrigeration prior to analysis were analyzed for pH and for the major cations, chloride and sulfate, and the nitrogen series. For the stored samples, the rainiest site was acidic with median pH 4.9, and rainfall weighted pH 4.77. Samples analyzed immediately on receipt at the laboratory had median acidity of pH 4.2 and rain-weighted pH 4.22. Samples that included some cloud water had acidity with a median pH 5.1 and rainfall weighted pH 5.17. Samples taken before and after the eruption of El Chichon in April 1982 showed no apparent effect of the stratospheric sulfur on rainfall acidity. Electrical conductivity of the rainfall was equivalent to cation concentrations of 1 to 10 milliequivalents per liter. Chloride, a major cation, decreased with distance from the ocean sources. Sulfates values in the rainwater increased during southerly flow when Kilauea volcano was erupting, so that the sulfate to chloride ratio increased to tenfold that for seawater. Organic nitrogen forms made up about 40% of the total nitrogen content of the rainfall, and calculated organic-N loadings from the annual rainfall had values from 4.39 to 1.62 kg/ha/yr. The pH values of 4.2 to about 5.0 support the contention that the acidity in naturally occurring rainfall in remote areas has a pH slightly below 5.0.
W86-02631

TOXIC ORGANIC CHEMICAL TRANSPORT AND FATE IN GROUNDWATER SYSTEMS,
Princeton Univ., NJ.
R. A. Ferrara, and W. G. Gray.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232890/AS, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, New Jersey Water Resources Research Institute, New Brunswick, April, 1985. 13 p, 8 fig 2 ref. USGS G857-05. 14-08-0001-G-857.

Descriptors: *Groundwater pollution, Mathematical modeling, *New Jersey, Path of pollutants, Landfills, Industrial wastes.

This project involved the development and application of a mathematical model of groundwater contaminant transport and fate. An existing two-dimensional groundwater flow and contaminant transport model was modified to include contaminant transformation processes including nonlinear adsorption and description, biodegradation, hydrolysis and volatilization. The model was applied to Price's Landfill in Pleasantville, New Jersey. Comparisons were made between predictions of contaminant migration with and without transformation processes. The simulations presented provide some guidance as to the range of values within which it is clearly necessary or clearly unnecessary to model transformation processes in addition to transport processes. The impact on a model's prediction of the migration of a contaminant plume can be substantial. Similarly, when such models are used to evaluate aquifer restoration techniques, the consideration of transformation terms can also be important. Assuming a conservative substance can lead to erroneous predictions regarding the extent and duration of aquifer restoration necessary to obtain a given level of decontamination.
W86-02634

SEDIMENT AND PESTICIDE/HERBICIDE TRANSPORT RELATIONSHIPS,
Kansas Water Resources Research Inst., Manhattan.
A. D. Parr, D. D. Lane, and C. Richardson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232973/AS, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, January, 1985. 28 p, 16 fig, 2 tab, 8 ref. USGS G843-04. 14-08-0001-G-843.

Descriptors: *Kansas, *Sediment transport, *Path of pollutants, *Non-point pollution, Agriculture, Diffusion, Runoff, Laboratory simulation.

This study examined the entrainment of interstitial soil pore water by overland sheet flow. A series of laboratory experiments were performed in which water was passed at various velocities and depths over a soil bed. The soil was saturated with a sodium bromide solution prior to each experiment and the runoff water was sampled at the end of the flume. The samples were anlyzed for bromide concentration then concentration and mass loss rate curves were developed. A diffusion model was formulated and used to describe mass transfer across the soil surface. The experimental data was fitted to the diffusion model with a procedure developed to determine diffusion parameters from empirical data. In general, the experimental data conformed quite well to the diffusion model, with the diffusion coefficient depending on velocity and soil surface roughness.
W86-02642

STUDY OF THE MECHANISMS CONTROLLING GASOLINE HYDROCARBON PARTITIONING AND TRANSPORT IN GROUNDWATER SYSTEMS,
Connecticut Univ., Storrs. Inst. of Water Resources.
G. E. Hoag, C. J. Bruell, and M. C. Marley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-242907/AS, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, October 1984. 51 p, 13 fig, 7 tab, 30 ref, append. USGS G832-06. 14-08-0001-G-832.

Descriptors: *Groundwater pollution, *Hydrocarbons, Solvents, Interfaces, *Path of pollutants, Gasoline fuel, Organic compounds, Pollutant identification, Soil venting processes.

The environmental impacts of spilled gasline on ground water resources are severe and long-term. Environmental regulation of underground fuel storage is limited in the U.S. Transport phenomena controlling the fate of gasoline hydrocarbons in soil and groundwater systems are poorly understood. Methods to restore contaminated gasoline spill sites are limited and usually only address recoverable gasoline product. A gasoline hydrocarbon fingerprinting method was developed for aliphatic, aromatic, and halogenated compounds as a qualitative and quantitative research tool. A 1/8 ins. x 10 ft. stainless steel column packed with 5% AT-1200 + 1.75% Bentone 34 on Chrom-W-AW 100/120 mesh was used with a 15 cm3/min Helium carrier gas flow rate. Flame ionization and Mass Spectroscopy were used as methods for quantitative and qualitative analysis, respectively. Electron capture detection was used for quantitative halocarbon analysis. More than 50 hydrocarbons were identified and quantified in several gasoline grades by various manufacturers. Soil venting experiments indicate that gasoline can be readily volatilized from the vadoze zone using induced vaccuum or pressure. Experiments were run on several soils and various air flow rates. It was found that Dalton's and Raoult's Laws were followed in the venting process. Therefore, equilibrium chemistry can be used to model the venting of gasoline from soils.
W86-02659

SEDIMENT-WATER COLUMN EXCHANGES OF NUTRIENTS AND OXYGEN IN THE TIDAL JAMES AND APPOMATTOX RIVERS,
Virginia Inst. of Marine Science, Gloucester Point.
C. F. Cerco.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-242915/AS, Price codes: A06 in paper copy, A01 in microfiche. March 1985. 110 p, 43 fig, 10 tab, 11 ref, 3 append.

Descriptors: *Sediments, Sediment-water interface, Oxygen demand, Nutrients, *Nitrogen, *Phosphorus, Tidal rivers, Estuaries, *James River, *Appomattox River, *Chesapeake Bay, Virginia, Dissolved oxygen, Ammonium, Orthophosporus, Path of pollutants.

Fluxes between the sediments and overlying water of ammonium, nitrate, total phosphorus, ortho phosphorus, and dissolved oxygen have been measured in the tidal James and Appomattox Rivers, Va. A total of 68 nutrient flux measures, 203 oxygen flux measures, and 18 control measures were collected in the summer months, 1983 and 1984. Ammonium is predominantly released from the sediments at a mean rate of 9.82 mg/sq m/hr. Nitrate is predominantly taken up by the sediments at a mean rate of 1.53 mg/sq m/hr. Total phosphorus is taken up by the sediments at a mean rate of 1.67 mg/sq m/hr. Ortho phosphorus may be taken up or released. Mean flux is an uptake of 0.75 mg/sq m/hr. Dissolved oxygen is taken up at a mean rate of 44 mg/sq m/hr.
W86-02660

DETECTION AND EFFECTS OF APERIODIC LEACHATE DISCHARGES FROM LANDFILLS,
Connecticut Univ., Storrs. Inst. of Water Resources.
J. Stuart, H. Luce, S. Smith, and R. Black.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-242949/AS, Price codes: A10 in paper copy, A01 in microfiche. Completion Report, September 1984. 184 p, 50 fig, 28 tab, 69 ref, 2 append. USGS G832-04. 14-08-0001-G-832.

Descriptors: *Landfills, *Leachates, Waste dumps, *Groundwater pollution, Path of pollutants, Pollutant identification, Aperiodic leachate pulses, Water analysis, Soil analysis.

Pilot studies showed that aperiodic pulses of leachate were emanating from a nearby landfill. To evaluate methods of monitoring aperiodic leachate pulses and to characterize their composition, this study was initiated. Monthly variations in pH, specific conductivity, Ca, Cl, Fe, Mg, NH-4, NO3, K and Zn were monitored in water taken at well point depths of about 10, 20, and 40 feet from six wells and from nearby surface streams. By ground electromagnetic conductivity, a leachate plume was located emanating in a southerly direction from the landfill. A limited organic dye test showed groundwater movement to the south-southwest from the landfill to be rapid and descending. Purgeable hydrocarbons and halocarbons, compounds including methylene chloride, chloroform, toluene, and benzene were found in the leachate and in some residential wells adjacent to the landfill. By high resolution, capillary column gas chromatography (HRCCGC) and HRCCGC mass spectroscopy, base/neutral extractable organic compounds were obtained from well and surface stream water extracts. General compound classes identified by HRCCGC included a group of organic iodo compounds, alkylated phenols, phthlates, aromatics and some N containing heterocyclics. Analyses of soils from landfill drainages, using 6 profiles from two transects, yielded levels of Ca, Mg, Fe, Mn, Cu, Cr, Pb not found in control soils, and showed contamination of groundwater in the intermittent drainageway to the south. The flush of leachates was found to be affected by precipitation levels proving the aperiodic nature of the leachate movement from the landfill.
W86-02663

ACID RAIN BUFFERING POTENTIAL IN OREGON CASCADE LAKES: SECONDARY MINERAL SOLUBILITY CONTROL OF SOLUTION IONIC COMPOSITION,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
P. O. Nelson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-246734/AS, Price codes: A02 in paper copy, A01 in microfiche. Oregon Water Resources Research Institute Publication WRRI-100, Corvallis, March, 1985. 16 p, 2 fig, 7 tab, 18 ref. USGS G864-02. 14-08-0001-G-864.

Descriptors: Lakes, *Acid rain, *Geochemistry, Speciation, *Buffering, *Aluminum, Water properties, Water chemistry, Chemical properties, *Oregon.

Results from Nelson and Delwiche (1983) were extended to determine possible geochemical controls on the chemical composition of Oregon's Cascade lakes. Two types of chemical equilibrium relationships were developed: (1) predominance-area diagrams relating primary and secondary minerals to determine the phase most likely to be in thermodynamic equilbrium with lake water solutions and (2) chemical speciation calculations, emphasizing aluminum, for the controlling geochemical phase and lake susceptibility to acidification. Comparison of chemical compositions of eight lakes to the phase regions of predominance diagrams indicated that kaolinite was the secondary mineral phase controlling solution chemistry. Gibbsite controlled solution chemistry in one lake. Speciation calculations showed aluminum to be predominantly in hydroxide complexes with free aluminum ion concentration never exceeding 2% of monomeric aluminum. Fluoride and sulfate complexes were generally negligible. Stability indices from solution compositions gave agreement with predicted controlling secondary mineral phases from predominance-area diagrams. The Oregon Cascade lakes studied appear to be in equilibrium or derived from secondary mineral phases formed during the incongruent dissolution of parent feldspar minerals. These geochemical forms, known for their low dissolution kinetics and resistance to chemical weathering, explain the dilute solution chemistry and weak buffering capacity of the lakes and their susceptibility to acidification.
W86-02667

AQUATIC BACTERIA AND PESTICIDE DEGRADATION,
Oregon State Univ., Corvallis. Dept. of Microbiology.
R. J. Seidler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-246775/AS, Price codes: A03 in paper copy, A01 in microfiche. Oregon Water Resources Research Institute Publication WRRI-93, Corvallis, August 1984. 30 p, 6 fig, 5 tab, 23 ref. USGS G864-03. 14-08-001-G-864.

Descriptors: *Aquatic bacteria, *Pesticides, *2-4-D, Chlorinated aromatics, Biodegradation, Alcaligenes, Pseudomonas, Bacteria, DNA plasmids.

Thirty bacteria exhibiting the ability to utilize the herbicide 2,4-dichlorophendoxy acetate (2,4-DD) have been isolated from aquatic habitats in western Oregon. Bacteria utilizing 2,4-D were obtained from two-thirds of attempted enrichment trials. All bt one of the isolates are gram-negative rods, oxidase positive, and aerobic. Those examined have lateral or subpolar flagella and have 61-67% guanine plus cytosine content in the chromosomal DNA. The cultures conform to bacteria of the genus Alcaligenes or Pseudomonas. Enrichment experiments revealed that approximately 10-20 indigenous bacteria per 100 ml of water were capable of using 2,4-D supplied at high concentrations of 150 micrograms of 2,4-D per ml water. About 800 or more bacteria 100 ml of water can use 1-5 micrograms/ml. Over 60% of the isolates contained detectable DNA plasmids with molecular weights in the range of 10-53 megadaltons. One large plasmid, designated pEML 159, had many similarities with a plasmid obtained from an Alcaligenes species isolated in Australia. Attempts to transfer between bacteria the genetic ability for utilizing 2,4-D met with limited success. Only pEML 159 was transmissable, and only to species closely related to the donor strain. No genetic transfer of 2,4-D utilization ability into bacteria numerically common in aquatic habitats was detected. It is concluded that aquatic bacteria which utilize 2,4-D are widespread but are present in relatively low numbers. Some of these organisms are able to use well over 150 micrograms/ml of 2,4-D and can rapidly cleanse aquatic environments containing much smaller levels of the pesticide. These bacteria are usually able to metabolize other chlorinated aromatics of the 2,4-D structural family.
W86-02671

FATE OF SELECTED PRIORITY POLLUTANTS IN REGIONAL WASTEWATER TREATMENT PLANTS IN PUERTO RICO AND THEIR IMPACT OF THE QUALITY OF COASTAL RECEIVING WATERS,
Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-02674

IMPACTS OF INDIVIDUAL ON-SITE SEWAGE DISPOSAL FACILITIES ON MOUNTAIN VALLEYS - PHASE II - WATER-QUALITY CONSIDERATIONS,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
S. P. Luttrell, and C. E. Brockway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249159/AS, Price codes: A05 in paper copy, A01 in microfiche. Idaho Water and Energy Recources Research Institute, Moscow, Completion Report, May, 1984. 74 p, 30 fig, 6 tab, 29 ref. USGS G839-03. 14-08-0001-G839.

Descriptors: *Water pollution sources, *Idaho, *Groundwater quality, *Septic tanks, Septic wastewater, Water quality, Aquifers.

A rapid increase in residential development utilizing primarily on-site sewage disposal systems is occurring in the Big Wood River valley in Idaho. Hydrologic characteristics of the Big Wood River and aquifer systems were evaluated addressing ground-water characteristics, groundwater/surface-water relationships, and water quality in relation to on-site sewage disposal systems. Ground water is unconfined and often occurs close to land surface in unconsolidated valley-fill deposits, which range from less than 40 feet to more than 180 feet in thickness. Ground-water underflow at Halley was calculated to be approximately 40,000 acre feet per year. A ground-water quality network of approximately 50 wells was established from which samples were collected in July-August, 1983. Approximately 20 wells were then selected from which samples were collected through March, 1984. The mean concentrations of nitrate-n, chloride, and orthoshosphate were 0.53, 2.4, and .013 mg/L, respectively. Nitrate-n concentrations ranged from 0.1 to 2.2 mg/L, well below the USEPA recommended limit of 10 mg/L. The mean specific conductance was 371 micromhos/cm at 25 deg C. Mean concentrations on nitrate-n, chloride, and orthophosphate from surface-water samples were 0.44, 1.8, and .015 mg/L, respectively. Ground-water levels were measured in approximately 60 wells from which a water-table contour map and a ground-water/surface-water profile were constructed for July-August, 1983. The profile indicates hydraulic connection between ground water and surface water in much of the study area.
W86-02694

HYDROLOGIC AND WATER QUALITY IMPACTS OF PEAT MINING IN NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Forestry.
J. D. Gregory, R. W. Skaggs, R. G. Groadhead, R. H. Culbreath, and J. R. Bailey.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB85-249175/AS, Price codes: A11 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Completion Report No 214, August, 1984. 215 p, 93 fig, 31 tab, 16 ref.

Descriptors: *Surface drainage, *Subsurface drainage, *Water quality, *Peat, Peat soils, Mine drainage, Peat mining, Coastal Plains, North Carolina.

The surface and subsurface hydrologic impacts of peat mining were studied at a pocosin site in the lower Coastal Plain of Northeastern North Carolina. Runoff and water quality data were collected for discharge from field ditches draining sites being actively mined and sites with natural vegetation. A water management model (DRAINMOD) was adapted to simulate surface hydrology. The finite element method was used to evaluate the effects of peat mining on vertical seepage to a deep aquifer and lateral seepage from a nearby lake. Volume, duration, and peak flow of storm discharge from field ditches was greater from the mining sites than from those having natural vegetation. Baseflow between storm events was greater from vegetated sites than from the mined sites. Reduced evapotranspiration, reduced infiltration capacity aand grading and sloping of the surface are most likely responsible for those differences. Relatively high concentrations of organic sediment in field ditch outflows resulted from the highly erodible state of the mined surface and the field ditch channels. However, much of the sediment load settled in the weir stilling ponds and concentrations decreased downstream in collector and main anels due to settling and dilution. Concentrations of nitrogen and phosphorus varied little among sampling sites but were considerably higher than those reported in outflow from similar sites with natural vegetation in several other studies. Mining appeared to have no significant impact on concentrations of K, Ca, Mg, and Cl in outflows.
W86-02696

SOME HYDROLOGIC ASPECTS OF PROPOSED COAL MINING IN THE NORTH FORK OF THE FLATHEAD RIVER HEADWATERS AREA, NORTHWEST MONTANA AND SOUTH EAST BRITISH COLUMBIA,
Montana Bureau of Mines and Geology, Butte.
For primary bibliographic entry see Field 4C.
W86-02707

TRANSFER OF INFORMATION AND TECHNOLOGY ON ACID MINE DRAINAGE FROM RESEARCH TO THE USER,
West Virginia Univ., Morgantown. Water Research Inst.
C. L. Dodson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101300/AS, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, 1984. 9 p. USGS G877-222. 14-08-0001-G877.

Descriptors: *West Virginia, *Acid mine drainage, Education, Technology transfer, Water quality standards, Iron, Heavy metals, Reviews, Information exchange, Communication, Sediment, Stream pollution, Fish, Aquatic life, Water pollution effects, Ecology, Chemical properties.

The project was designed to inform the user of results of the acid-mine-drainage research of the state water-research-institute program. A chief objective was to supply the Division of Water Resources, West Virginia Department of Natural Resources, and others having a like concern, technology or information that can be used to aid in establishing rational water-quality standards for iron in streams of the state and region. Information-transfer methods included meetings with principal users to determine needs, close personal contacts for individual and small-group discussions, written communications that included reports, a radio program, and a seminar held by principal investigators and others and users and others concerned with use. The most practical method of transferring information during the period of the project was by direct personal contact, and the method having the greatest impact was the seminar. The project made a valuable contribution to the water-resources needs of the state, and the effectiveness of this project indicates that such a technology/information-transfer project should be included in the annual programs of each state water research institute.
W86-02711

ADSORPTION OF HEAVY METALS ON SEDIMENTS IN STREAMS RECEIVING ACID MINE DRAINAGE,
West Virginia Univ., Morgantown. Water Research Inst.
B. I. Haddad, and C. R. Jenkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101334/AS, Price codes: A04 in paper copy, A01 in microfiche. Completion Report 1984. 48 p, 2 fig, 9 tab, 33 ref, append. USGS G 877-203. 14-08-0001-G877.

Descriptors: *West Virginia, *Acid mine drainage, Heavy metals, Aluminum, Iron, Manganese, Zinc, Sediments, Water quality standards, Bottom sediments, Suspended sediments, Adsorption, Oxides, Stream pollution, Sediment distribution, Chemical composition.

Sediment samples were collected, from the Monongahela River, between Morgantown, West Virginia and Point Marion, Pennsylvania, and from two tributaries, Robinson Run and West Run. Distribution of bottom sediment in the navigation channel of the Monongahela River was found to be uneven. Sediment resuspension caused by towboats traffic was significant. A sequential extraction procedure conducted on river sediment showed that the Fe-Mn oxide phase of the sediment held the largest share of heavy metals. Heavy metals monitored were Al, As, Cd, Cr, Fe, Mn, Se, and Zn. As and Se concentration were not reliable because the equipment and procedure used were inadequate to detect concentration that were present. The organic carbon content of the sediment was found to be higher than comparable streams. The effect of pH 5.0 on heavy metal release from sediment was investigated. Mn and Zn were the only heavy metals that exhibited potential for release from sediment. The heavy metals content of the Monongahela River sediment was higher than comparable rivers. A comparison of heavy metals content in sediment from Monongahela River and tributaries showed a higher content in the river sediment.
W86-02714

RELATIONSHIP BETWEEN CHEMICALLY DETERMINED AND BIOLOGICALLY AVAILABLE FORMS OF PHOSPHORUS IN LAKES AND STREAMS,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
F. B. Trama, and A. W. McIntosh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-126117/AS, Price codes: A05 in paper copy, A01 in microfiche. Final Technical Completion Report, September 1985. 73 p, 23 fig, 42 tab, 50 ref. B-076-NJ. 14-34-0001-9152.

Descriptors: *Reservoirs, Tributaries, Storm water, Water quality, *New Jersey, Phosphorus, *Eutrophication, Bioassay, Limnology, Water pollution.

Concentrations of total, total dissolved, soluble reactive and bioavailable phosphorus were determined monthly for three years in two proximal reservoirs and their major tributaries. Spruce Run reservoir was a eutrophic on-stream impoundment, and Round Valley reservoir was a mesotrophic pumped storage body of water. Baseflow and stormflow conditions were monitored for the main tributaries of Spruce Run reservoir. Temperature, light transmission, dissolved oxygen concentration and chlorophyll a levels were measured monthly in both reservoirs. Stormflows contributed about 33% of the annual TP load from Spruce Run Creek and 53% from Mulhockaway Creek to Spruce Run reservoir. Mean baseflow BAP/TP ratios were 0.43 and 0.35 for Spruce Run and Mulhockaway Creeks, respectively, but the stormflow BAP/TP ratio of 0.17 was the same for both streams. Mean TP concentrations were 15 and 29 microgram/liter in Round Valley and Spruce Run reservoirs, respectively, but the three-year average BAP/TP ratio of 0.21 was the same for both reservoirs. Both reservoirs were efficient phosphorus traps, especially with respect to BAP concentrations, which were reduced by 72% in Spruce Run reservoir. Secchi disc depth, chlorophyll a and dissolved oxygen concentrations in Round Valley reservoir responded quickly to an episodic enrichment of phosphorus but only the chlorophyll a showed a rapid recovery. The rate of hypolimnetic oxygen consumption (AHOD) of 0.06 microgram O2/cm2/day in Round Valley failed to improve during the three years of investigation. Phosphorus budgets were assembled for both reservoirs and used to compare predicted TP concentrations to those observed. An equilibrium-based model proposed by Lee et al. gave poor agreement. The Dillon-Rigler model accurately predicted the observed annual mean TP concentrations and not the springtime TP concentration it was supposed to predict.
W86-02721

EVALUATION OF DATA REQUIREMENTS FOR GROUNDWATER CONTAMINANT TRANSPORT MODELING,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. W. Strecker, W. Wen-Sen Chu, and D. P. Lettenmaier.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-126133/AS, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Series Technical Report No 94, May 1985. 92 p, 30 fig, 13 tab, 45 ref. USGS C-3173-G. 14-08-0001-G1059.

Descriptors: *Groundwater, *Contaminant transport, *Data requirements, *Path of pollutants, *Parameter identification, *Method of characteristics, *Computer models, Prediction, Mathematical models, Risks.

Groundwater flow and contaminant transport models have been widely used for planning and design purposes in the past decade. The predictive ability of these models is limited by the assumptions and approximations introduced in the model governing equations and their solutions, the model parameters used, and the availability and quality of the model calibration data. By combining a parameter identification algorithm with the united states geological survey's Method of Characteristics (USGS-MOC) Code and using two synthetic aquifers, this study evaluated the effects of data availability and uncertainty on groundwater contaminant transport prediction by a series of numerical experiments. The study results indicate that the predictive ability of USGS-MOC is limited unless relatively extensive and good quality data are available. Extending the time length of observation was generally more effective in improving parameter estimates than adding more observation wells. Finally, provided that all boundary conditions are known, the accurate estimation of transmissivity in an aquifer is by far the most important step toward more reliable prediction of contaminant transport. The experimental results showed that when only limited data were available for model calibration, the predicted contaminant concentrations could be significantly in error in just five years of simulation. Based on the study results, we suggest that with typical data bases, groundwater flow and contaminant transport model results should be accompanied by detailed uncertainty analysis prior to implementation for planning or design purposes.
W86-02723

MODELING OF OVERLAND FLOW BY THE DIFFUSION WAVE APPROACH,
Kentucky Water Resources Research Inst., Lexington.
R. S. Govindaraju, S. E. Jones, and M. L. Kavvas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132388/AS, Price codes: A05 in paper copy, A01 in micro-

fiche. Research Report No. 159, August 1985. 79 p, 13 fig, 1 tab, 18 ref, 1 append. USGS G-908-03. 14-08-0001-G-908(FY 84).

Descriptors: *Kentucky, *Pollutant transport, *Path of pollutants, *Overland flow, Model studies, Oil fields, Oil pollution, Flow characteristics, Flow pattern.

Water quality degradation and a need for precise answers to transport of pollutants by overland flow were studied with special reference to the evaporation pits located adjacent to streams in the oil producing regions of eastern Kentucky. The practical shortcomings of the state-of-the-art kinematic wave are discussed and a new mathematical modeling approach for overland flows using the more comprehensive diffusion wave is attempted as the first stem in solving this problem. A Fourier series representation of the solution to the diffusion wave is adopted and found to perform well. The physically justified boundary conditions for steep slopes is considered and both numerical and analytical schemes are developed. The zero-depth-gradient lower condition is used and found to be adequate. The steady state analysis for mild slopes is found to be informative and both analytical and numerical solutions are found. The effect of imposing transients on the steady state solution are considered. Finally the cases for which these techniques can be used are presented.
W86-02738

IDENTIFICATION OF SOIL-WATER CHEMICAL PARAMETERS FOR THE PREDICTION AND TREATMENT OF SUSPENDED SOLIDS IN SURFACE WATER RESERVOIRS OF COAL MINE LANDS,
Kentucky Water Resources Research Inst., Lexington.
For primary bibliographic entry see Field 5D.
W86-02739

INVESTIGATION OF POLLUTION IN A KARST AQUIFER UTILIZING OPTICAL BRIGHTENER,
Kentucky Water Resources Research Inst., Lexington.
For primary bibliographic entry see Field 5A.
W86-02740

CONTROLS ON PHOSPHORUS MOBILITY IN THE POTOMAC RIVER, NEAR THE BLUE PLAINS WASTEWATER TREATMENT PLANT,
Geological Survey, Reston, VA. Water Resources Div.
P. P. Hearn.
Available from Dist Branch, USGS 604 S. Pickett St. Alexandria, VA 22034. USGS Professional Paper 2231, 1985. 46 p, 29 fig, 2 tab, 56 ref.

Descriptors: *Potomac River, *Wastewater disposal, *Sewage disposal, *Phosphates, *Path of pollutants, Sediments, Bottom sediments, Sorption, Nutrients.

The removal of phosphorus from wastewater treatment plant effluents is desirable, both in terms of water quality, and also because it can cost less than nitrogen or carbon removal. The biological availability of phosphorus in a sediment-water system is controlled by a number of processes. Effective decision-making requires a data-collection effort tailored to specific locations. The Blue Plains wastewater treatment plant is the largest point source of phosphorus in the entire Potomac River basin, discharging an average of 2000 kilograms of phosphorus into the river each day. The transport of phosphorus near the treatment plant was found to be affected primarily by the circulation regime and chemical reactions with suspended and bottom sediments. The effect of river discharge on the convective transport of phosphorus near the outfall is significantly reduced by a mid-river shoal area that confines the flow path of the effluent to an embayment on the eastern side of the river for a distance of 2 miles below the outfall. This embayment serves as a sediment trap, where protection from bottom scour permits clay-rich sediments to accumulate. Mean residence time is 2-1/2 days for the effluent to leave the embayment area. The amount of dissolved phosphorus available within the water column is regulated primarily by sorption and precipitation reactions with suspended and bottom sediments. Amorphous ferric oxyhydroxides are the primary phase responsible for phosphorus sorption. A substantial amount of phosphorus is associated with residual iron and aluminum from within the treatment plant, especially in sediments close to the outfall. The concentration of amorphous iron in fine-grained sediments is significant with respect to the circulation regime within the embayment. Phosphorus has accumulated in areas of fine-grained sediment deposition. Conversely, the absence of these compounds in sand-rich sediments near the outfall has apparently facilitated the precipitation of the ferrous phosphate mineral vivianite. Approximately 13 percent of the phosphorus discharged between September 1977 and August 1980 has been retained in the embayment. A diurnal cycle corresponds to the metabolic utilization of phosphorus by phytoplankton. This cyclic sorption is superimposed upon a constant and non-cyclic sorption of phosphorus by inorganic phases. (USGS)
W86-02762

PESTICIDES IN THE NATION'S RIVERS, 1975-1980, AND IMPLICATIONS FOR FUTURE MONITORING,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-02764

WATER-QUALITY CHARACTERISTICS OF STREAMS IN THE PICEANCE CREEK AND YELLOW CREEK DRAINAGE BASINS, NORTHWESTERN COLORADO,
Geological Survey, Meeker, CO. Water Resources Div.
R. L. Tobin, H. E. Stranathan, and K. J. Covay.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4261, 1985. 80 p, 35 fig, 14 tab, 34 ref.

Descriptors: *Chemical analyses, *Energy, Water resources, *Colorado, Water quality, *Piceance Creek basin, *Yellow Creek basin.

Physical and chemical data for streams in the Piceance Creek and Yellow Creek drainage basins, Colorado collected during the 1977-81 water years are summarized. Stream temperatures ranged from -0.5 to 35.0 degrees Celsius and were warmest near the downstream reaches of Piceance and Yellow Creeks. Minimum concentrations of dissolved oxygen were greater than 3.0 milligrams per liter in Piceance and Yellow Creeks, and concentrations of dissolved oxygen exceeded saturation during periods of active photosynthesis. Values of pH in streams ranged from 6.9 to 9.0 and were least during snowmelt runoff and greatest in low flows in the lower reaches of Piceance and Yellow Creeks. Concentrations of suspended sediment exceeded 100,000 milligrams per liter in localized runoff. Specific conductance varied inversely with discharge. Sodium, magnesium, bicarbonate, and sulfate ions and concentration ranges of dissolved solids between 400 and 1,700 milligrams per liter were characteristic of the water quality of the perennial streams. Calcium and bicarbonate dominated the major ions, and concentrations of dissolved solids normally were less than 600 milligrams per liter in the intermittent streams during storm and snowmelt runoff. Augmentation to Piceance and Yellow Creeks from ground-water sources in the lower reaches of both streams increased concentrations of dissolved solids several thousand milligrams per liter during medium and low flows and caused a change in water-quality type from sodium magnesium bicarbonate to a high-percentage sodium bicarbonate. Increases in dissolved concentrations of arsenic, boron, fluoride, lithium, strontium, and sulfate were related to ground-water sources or discharges from areas of energy resource development. (USGS)
W86-02767

RECONNAISSANCE OF CHEMICAL QUALITY OF SURFACE WATER IN THE UPPER VIRGIN RIVER BASIN, UTAH, ARIZONA, AND NEVADA,
Geological Survey, Salt Lake City, UT. Water Resources Div.
G. W. Sandberg, and L. G. Sultz.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. Utah Department of Natural Resources, Salt Lake City, Technical Publication 83, 1985. 69 p, 7 fig, 9 tab, 27 ref.

Descriptors: Water quality, Salinity, Surface water, Sediment transport, Chemical analyses, Water analysis, *Virgin River basin, Reconnaissance studies, *Utah, *Arizona, *Nevada.

The Virgin River drainage from headwaters in Utah to Littlefield, Arizona has an area of about 5,090 square miles in southwestern Utah, northwestern Arizona, and southeastern Nevada. Water-quality data were obtained from 1 to 5 times at 74 sites in the basin between August, 1981 and September, 1982. Tributary inflow to the Virgin River generally contained smaller dissolved-solids concentrations than did the river during low flow and larger concentrations during high flow. LaVerkin Hot Springs, with a dissolved solids concentration of nearly 10,000 milligrams per liter, contributes a flow of approximately 11 cubic feet per second to the river. Major ions from the springs were sodium and chloride. Dissolved solids in the river system ranged from 56 milligrams per liter at Cascade Spring, Utah, to 2,620 milligrams per liter at Littlefield, Arizona. Calcium and sulfate were predominant ions although other ions were in greater concentration in some reaches. Sediments loads ranged from 0.13 to 3,582 tons per day 39 samples collected in August, 1981 and May, 1982. The maximum recorded sediment load was 1,930,000 tons per day prior to this investigation (1980). Dissolved-oxygen concentrations did not indicate dissolved-oxygen depletion. Sanitary conditions may be degraded downstream from livestock areas. Pesticide concentrations were minimal where sampled. (USGS)
W86-02768

SIMULATING UNSTEADY TRANSPORT OF NITROGEN, BIOLOGICAL OXYGEN DEMAND AND DISSOLVED OXYGEN IN THE CHATTAHOOCHEE RIVER DOWNSTREAM FROM ATLANTA, GEORGIA,
Geological Survey, NSTL Station, MS. Water Resources Div.
H. E. Jobson.
Available from Dist Branch, USGS 604 S. Pickett St. Alexandria, VA 22034. USGS Water-Supply Paper 2264, 1985. 36 p, 17 fig, 3 tab, 25 ref.

Descriptors: *Computer models, Water pollution sources, *Biological oxygen demand, Nitrification, Water quality, *Path of pollutants, Temperature models, Water-quality models, *Georgia, *Chattahoochee River, *Dissolved oxygen, *Nitrogen.

As part of an intensive water-quality assessment of the Chattachoochee River, repetitive water-quality data were obtained at 12 sites along a 69 kilometer reach of the river downstream of Atlanta, Georgia. Concentrations of seven constituents (temperature, dissolved oxygen, ultimate carbonaceous biochemical oxygen demand (BOD), organic nitrogen, ammonia, nitrite, and nitrate) were obtained during two periods of 36 hours, one starting on August 30, 1976, and the other starting on May 31, 1977. The study reach contains one large and several small sewage outfalls and receives the cooling water from two large powerplants. An unsteady water-quality model of the Lagrangian type was calibrated using the 1977 data and verified using the 1976 data. The model provided a good means of interpreting these data even though both the flow and the pollution loading rates were highly unsteady. A kinetic model of the cascade type was found to accurately describe the physical and biochemical processes occurring in the river. All rate coefficients, except reaeration and those describing the resuspension of BOD were fitted to the 1977 data and verified by use of the 1976 data. The study showed that at steady low flow about 38 percent of the BOD settled without exerting an oxygen

demand. This settled BOD was resuspended at high flow and exerted an immediate oxygen demand. About 70 percent of the ammonia extracted from the water column was converted to nitrite but the fate of the remaining 30 percent is unknown. Photosynthetic production was not an important factor in the oxygen balance during either run. (USGS)
W86-02769

APPRAISAL OF WATER-QUALITY CONDITIONS, LOWER BLACK RIVER, WINDSOR COUNTY, VERMONT,
Geological Survey, Bow, NH. Water Resources Div.
K. W. Toppin.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 82-4116, 1983. 61 p, 11 fig, 7 tab, 17 ref.

Descriptors: Water quality, *Hydroelectric power, *Nutrients, *Algal growth, *Primary productivity, *Preimpoundment, Aquatic life, Secondary wastewater, Waste treatment, Nuisance algal, Organic loading, Oxygen demand, Trace elements, Conductance, Organic carbon, Town of Springfield, *Vermont, Black River.

Six hydroelectric power dams are planned along a 22-mile reach of the lower Black River in southeastern Windsor County, Vermont. Data were collected at 10 stations, during water years 1977-81, to appraise quality conditions before construction. Average specific conductance of Black River is 101 micromhos indicating low concentrations of dissolved solids. Concentrations of common constituents and minor elements were generally low and within safe levels for aquatic life. Near-saturated dissolved oxygen concentrations and relatively low mean total organic carbon concentrations indicate little oxygen-consuming substances in Black River. Mean total nitrogen concentrations ranged from 0.31 mg/L (milligrams per liter) to 0.61 mg/L. The highest concentrations were most likely due to secondary waste discharges entering the river. Nitrate was the primary form of inorganic nitrogen, mean concentrations ranged from 0.13 to 0.27 mg/L. Concentrations seem high enough to promote excessive algal growth in the proposed Hawks Mountain Reservoir. Mean concentrations of total phosphorus ranged from 0.014 to 0.112 mg/L as P. Maximum concentrations at all stations generally exceeded U.S. Environmental Protection Agency suggested levels for water entering lakes and reservoirs. Mean orthophosphorus concentrations ranged from 0.005 to 0.029 mg/L, suggesting a potential for nuisance algal conditions to develop in the proposed reservoir. Mean algal growth potential concentrations ranged from 1.3 to 8.8 mg/L, falling within the moderately high to high productivity range. No pesticides and polychlorinated biphenyls were detected. (USGS)
W86-02770

STATISTICAL APPROACH TO EVALUATING THE RELATION OF COAL MINING, LAND RECLAMATION, AND SURFACE-WATER QUALITY IN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02775

INTEGRATED LAKE-WATERSHED ACIDIFICATION STUDY, VOLUME 2--HYDROLOGIC ANALYSIS,
Geological Survey, Albany, NY. Water Resources Div.
P. S. Murdoch, N. E. Peters, and R. M. Newton.
Electric Power Research Institute--ILWAS report EPRI EA-3221, Vol 2, 1984. 58 p, 18 fig, 11 tab, 31 ref.

Descriptors: Water budgets, Watershed hydrology, *Acid rain, Base flow, Groundwater runoff, Evapotranspiration, *Water pollution sources, *Adirondack Mountains, *New York, ILWAS.

A hypothesis of the Integrated Lake-Watershed Acidification Study has been that lakes receiving much of their inflow from deep soil horizons will be more alkaline than those receiving mostly surface runoff. Two similar lake basins in the West-Central Adirondack Mountains were studied. Both basins received about 120 centimeters of acid precipitation annually (pH 4.2). One lake is acidic (pH = 4.7), the other is neutral (pH = 7). Hydrologic and geologic data included (1) thickness of till and capacity to transmit water to the lake, (2) 'flashiness' of runoff and degree of flow augmentation by ground water, (3) flow-duration curves, (4) recession curves representing ground-water decline in winter, (5) monthly changes in watershed storage, including surface retention and soil moisture, and (6) magnitude of ground-water decline in summer and subsequent recharge in fall. The neutral lake receives about 10 times more ground water than the acidic lake. Large amounts of water applied over short periods (such as the spring snowmelt) increase the relative amount of shallow flow and thus increase lake-water acidity). (USGS)
W86-02777

WATER-QUALITY DATA FOR THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM IN SOUTHWESTERN NEW JERSEY, 1923-83,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02783

CHEMICAL AND BIOLOGICAL QUALITY OF SELECTED LAKES IN OHIO, 1978 AND 1979,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 2H.
W86-02786

LOW-FLOW CHARACTERISTICS OF STREAMS IN THE KISHWAUKEE RIVER BASIN, ILLINOIS,
Geological Survey, De Kalb, IL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02787

HYDROGEOLOGIC RECONNAISSANCE OF THE SAN MIGUEL RIVER BASIN, SOUTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02789

RUNOFF AND CHEMICAL LOADING IN SMALL WATERSHEDS IN THE TWIN CITIES METROPOLITAN AREA, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02794

QUALITY OF GROUND WATER IN MONITOR AND WILLIAMS TOWNSHIPS, BAY COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
F. R. Twenter, and T. R. Cummings.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4110, 1985. 41 p, 16 fig, 10 tab, 5 ref.

Descriptors: *Hydrogeology, Groundwater, *Groundwater pollution, *Groundwater movement, Water quality, Saline water, Coal mining, Bay County, *Michigan.

A hydrogeological study of Monitor and Williams Townships in Bay County, Michigan, was conducted during 1983-84. Migration of mineralized ground water from abandoned subsurface coal mines in Monitor and Williams Townships had been thought to effect the quality of domestic ground-water supplies in the area. To investigate the possibility, wells were installed to obtain geologic data and water samples; related data concurrently collected by other agencies also were analyzed. The principal geologic units are glacial deposits and the Saginaw Formation. Glacial deposits, 75 to 175 feet thick, are primarily clay underlain in places by sand and gravel. This sand and gravel is the primary source of potable ground water in the study area. Underlying the glacial deposits is the Saginaw Formation--a unit that is mostly shale and silty shale containing beds of siltstone, sandstone, and coal. Specific conductance of water from wells indicate that dissolved-solids concentration increases with well depth. About 50 percent of specific conductance values of water from wells more than 100 feet deep were equal to or greater than 5,000 microsiemens, whereas only 13 percent of the values of water from wells less than 100 feet deep were equal to or greater than 5,000 microsiemens. Chemical analyses of water from abandoned mines and the Saginaw Formation in areas without coal indicated that the Saginaw Formation is as likely to influence the water-quality characteristics of the glacial deposits as is water from abandoned mines. (USGS)
W86-02798

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
T. H. Thompson, R. Chappell, and D. L. Hart.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water Resources Investigations Report 83-4118-C, 1984. 5 p, 4 fig, 11 ref.

Descriptors: Groundwater, *Water quality data, Hydrogeology, *Groundwater quality, *Basin and Range province, *New Mexico, *Maps, *Dissolved solids.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps at a scale of 1:500,000 describing the ground-water quality of the New Mexico portion of the Basin and Range province. The first map shows the areal distribution of dissolved solids of ground water in the basin-fill deposits. The second map shows the areal distribution of the dominant chemical type of ground water in the basin-fill deposits. (USGS)
W86-02799

DATA COLLECTED BY THE U.S. GEOLOGICAL SURVEY DURING A STUDY OF URBAN RUNOFF IN BELLEVUE, WASHINGTON, 1979-82,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02811

ANALYSIS OF URBAN RUNOFF DATA AND EFFECTS ON THE SOUTH PLATTE RIVER, DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
S. R. Ellis, J. T. Doerfer, M. H. Mustard, S. R. Blakely, and J. W. Gibbs.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water Resources Investigations Report 84-4159, 1984. 66 p, 8 fig, 32 tab, 13 ref.

Descriptors: Tributary basins, *Land use, Rainfall, *Storm loads, Nutrients, Trace elements, *Denver, *Colorado, *Water pollution sources, *Urban runoff, Water quality, Load analysis.

Denver was selected for inclusion in the Nationwide Urban Runoff Program, sponsored by the U.S. Environmental Protection Agency and the U.S. Geological Survey. This report, prepared in cooperation with the Denver Regional council of governments, contains a synopsis of previous urban runoff studies in the Denver metropolitan area.

The report includes a description of the monitored basins, a summary of storm runoff-to-rainfall ratios and estimates of impervious retention, and constituent loads and concentrations from seven small basins. The data from six small and five tributary basins to the South Platte River are analyzed using regression analysis, resulting in two sets of regression equations to predict storm runoff volume and selected constituent loads. The regression equations may be used to estimate storm-runoff volume and constituent loads from unmonitored basins from 15 to 16,000 acres with effective impervious areas of 15 to 90 percent. The effects of urban runoff on the South Platte River in the Denver area are described in three ways. The three methods indicated that storm runoff was a significant contributor of total suspended solids, total organic carbon, total lead, and total zinc to the South Platte River. (USGS)
W86-02813

STREAMFLOW AND SPECIFIC-CONDUCTANCE DATA FOR SELECTED SITES, FEBRUARY 15 THROUGH APRIL 9, 1984, NEAR THE Y-12 PLANT, THE OAK RIDGE RESERVATION, TENNESSEE,
Geological Survey, Knoxville, TN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02817

WATER-QUALITY CHARACTERISTICS OF ABHA RESERVOIR, ABHA, SAUDI ARABIA,
Geological Survey, Atlanta, GA. Water Resources Div.
W. J. Shampine.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4248, 1984. 42 p, 6 fig, 4 tab, 5 ref.

Descriptors: Water quality, *Reservoir storage, *Water supply, *Phytoplankton, Nutrients, *Saudi Arabia, *Abha, Asir Mountains.

A water-supply reservoir for the town of Abha, in the Asir Mountain range in southwestern Saudi Arabia was studied by periodic, year-long sampling in 1980 to measure changes in some of the water-quality characteristics. Measurements included surface to bottom profiles of temperature, dissolved oxygen, pH, and Eh; surface and bottom chemical analyses; and surface phytoplankton analyses. In January 1980 the reservoir was isothermal and had a mean temperature of 13.8C. Thermal stratification had formed by April and was at a maximum in July, when the water temperature was 21.3C at the surface and 17.3C near the bottom of the reservoir. In April chemically reducing conditions developed in the hypolimnion; concentrations of iron, manganese, and hydrogen sulfide increased significantly. Below a depth of about 5 meters the water became anaerobic, the pH was reduced from 8.5 to 7.2, and the Eh became negative. The reservoir became isothermal again in November 1980 and the reducing conditions slowly dissipated. The dominant phytoplankton population in the reservoir varied from Cyanophyta in the winter and spring, to Chlorophyta in the summer, to diatoms in the fall. The concentration of Anacystis, Oscillatoria, and Aphanizomenon measured in the winter and spring indicate the possibility of some pollution to the reservoir. (USGS)
W86-02820

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE WEST OTTER AREA, ASHLAND AND BIRNEY-BROADUS COAL FIELDS, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02827

GEOHYDROLOGY AND GROUND-WATER FLOW AT VERONA WELL FIELD, BATTLE CREEK, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02840

GROUND-WATER RESOURCES AND POTENTIAL HYDROLOGIC EFFECTS OF SURFACE COAL MINING IN THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02841

HYDROLOGY OF MAJOR ESTUARIES AND SOUNDS OF NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 2L.
W86-02842

WATER-QUALITY CHARACTERISTICS FOR SELECTED SITES ON THE CAPE FEAR RIVER, NORTH CAROLINA, 1955-80--VARIABILITY, LOADS, AND TRENDS OF SELECTED CONSTITUENTS,
Geological Survey, Raleigh, NC. Water Resources Div.
J. K. Crawford.
Available from Distribution Branch, USGS, Alexandria, VA 22304. USGS Water-Supply Paper 2185-F, 1985. 44 p, 15 fig, 17 tab, 103 ref.

Descriptors: Water quality, Water quality standards, *Ions, *Trace elements, *Nutrients, *North Carolina, Specific conductivity, Hydrogen ion concentration, Sulfates, Nitrates, Mercury, Iron, Manganese, Phosphorus, Nitrogen, Phytoplankton, Eutrophication, *Development impacts, Cape Fear River, Haw River, Deep River, B. Everett Jordan Dam.

Historical water-quality data collected by the U.S. Geological Survey from the Cape Fear River at Lock 1, near Kelly, North Carolina, show increasing concentrations of total-dissolved solids, specific conductance, sulfate, chloride, nitrite plus nitrate nitrogen, magnesium, sodium, and potassium during the past 25 years. Silica and pH show decreasing trends during the same 1957-80 period. These long-term changes in water quality are statistically related to increasing population in the basin and especially to manufacturing employment. Comparisons of water-quality data for present conditions with estimated natural conditions indicate that over 50 percent of the loads of most major dissolved substances in the river at Lock 1 are the result of development impacts in the basin. Over 80 percent of the nutrients plus nitrate nitrogen, ammonia nitrogen, and total phosphorus presently in the streams originate from development. At four sampling stations on the Cape Fear River and its tributaries, recent water-quality data show that most constituents are always within North Carolina water-quality standards and Environmental Protection Agency water-quality criteria. However, iron, manganese and mercury concentrations usually exceed standards. Although no algal problems have been identified in the Cape Fear River, nitrogen and phosphorus are present in concentrations that have produced nuisance algal growths in lakes. (USGS)
W86-02848

WATER QUALITY IN THE NEW RIVER, CALEXICO TO THE SALTON SEA, IMPERIAL COUNTY, CALIFORNIA,
Geological Survey, San Diego, CA. Water Resources Div.
J. G. Setmire.
Available from Distribution Branch, USGS, 604 S. Pickett Street, Alexandria, VA 22304. USGS-Water-Supply Paper 2212, 1984. 42 p, 20 fig, 12 tab, 16 ref.

Descriptors: *Water pollution sources, *Organic loading, *Dissolved oxygen, *California, Natural recovery, Benthic invertebrates, New River, Calexico.

The New River, which crosses the international boundary and enters the United States at Calexico, California, often contains material having the appearance of industrial and domestic waste. In May 1977, during a 4-day water-quality reconnaissance, white-to-brown, extremely turbid water crossed the border and was sampled on three occasions. During periods of waste discharge, concentrations of total organic carbon in the river at Calexico ranged from 80 to 161 milligrams per liter and dissolved organic carbon ranged from 34 to 42 milligrams per liter; the maximum chemical oxygen demand was 510 milligrams per liter. To determine the occurrence of the organic material and its effects on downstream water quality, intensive sampling for chemical and biological characteristics was done in the New River from May 1977 to June 1978. Dissolved-oxygen concentration was measured along longitudal profiles of the River from Calexico to the Salton Sea. A dissolved-oxygen sag which developed downstream from the gage at Calexico varied seasonally. The sag extended farther downstream and had lower concentrations of dissolved oxygen during the summer months than during the winter months. High concentrations of organic material were detected as far as Highway 80, 19.5 miles downstream from the internatioal boundary. The numbers and diversities of benthic invertebrate organisms showed that very few were able to survive the water-quality conditions in the upper reaches of the river. Lower reaches had greater numbers and diversities of organisms. Standard bacterial indicator tests showed fecal contamination a health hazard, exists in the New River. (USGS)
W86-02849

PHOSPHORUS LOADING TO MCGRATH AND ELLIS PONDS, KENNEBECK COUNTY, MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
W. J. Nichols, J. W. Sowles, and J. J. Lobao.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4177, 1984. 20 p, 7 fig, 5 tab, 6 ref.

Descriptors: *Maine, *Lakes, *Limnology, Hydrology, *Phosphorus, Surface water, *Water pollution sources.

McGrath and Ellis Ponds in south-central Maine have been identified as having nuisance algae blooms. In 1978, a cooperative study between the U.S. Geological Survey and the Maine Department Environmental Protection was begun to evaluate areas in which restoration effort would best improve water quality of the ponds. Streamflow and phosphorus data were collected from 28 tributaries to the ponds, April 1 through September 30, 1978 and 1979. Phosphorus yields from each tributary watershed were compared to determine their relative importance to the phosphorus budgets of the ponds. Three tributaries to the ponds were estimated to contribute 44 percent of the phosphorus load, yet drain only 22 percent of the watershed. Phosphorus input to the ponds likely would be most easily reduced by instituting phosphorus control practices in parts of the basin drained by the three tributaries. (USGS)
W86-02859

OREGON GROUND-WATER QUALITY AND ITS RELATION TO HYDROGEOLOGIC FACTORS--A STATISTICAL APPROACH,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02860

OCCURRENCE OF NATURAL RADIUM-226 RADIOACTIVITY IN GROUND WATER OF SARASOTA COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
R. L. Miller, and H. Sutcliffe.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investi-

gations Report 84-4237, 1985. 34 p, 8 fig, 6 tab, 46 ref.

Descriptors: Radioactivity, Public health, Water supply, *Radium radioisotopes, *Groundwater, *Geochemistry, Solubility, Statistical analysis, Phosphates, Water treatment, *Water pollution sources, *Florida, Tampa.

Water that contains radium-226 radioactivity in excess of the 5.0-picocurie-per-liter limit set in the National Interim Primary Drinking Water Regulations was found in the majority of wells sampled throughout Sarasota County. Highest levels were found areally near the coast or near rivers and vertically in the Tamiami-upper Hawthorn aquifer where semiconsolidated phosphate pebbles occur. Analysis of data suggests that part of the radium-226 in ground water of Sarasota County is dissolved by alpha particle recoil. In slightly mineralized water, radium-226 concentrations are decreased by ion exchange or sorption. In more mineralized water, other ions compete with radium-226 for ion exchange or sorption sites. Dissolution of minerals containing radium-226 by mineralized water probably contributes a significant fraction of the dissolved radium-226. Two types of mineralized water were present in Sarasota County. One type is a marine-like water, presumably associated with saltwater encroachment in coastal areas; the other is a calcium magnesium strontium surfate bicarbonate type. In general, water that contains high radium-226 radioactivities also contains too much water hardness or dissolved solids to be used for public supply without treatment that would also reduce radium-226 radioactivities. (USGS)
W86-02861

GENERAL DESCRIPTION OF THE GEOHYDROLOGY AND BURIAL TRENCHES AT THE LOW-LEVEL RADIOACTIVE WASTE BURIAL FACILITY NEAR BARNWELL, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
B. B. McDonald.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-806, 1984. 23 p, 10 fig, 1 tab, 14 ref.

Descriptors: Geology, *Radioactive waste disposal, *Groundwater hydrology, Waste burial, *Path of pollutants, Barnwell, *South Carolina, *Hydrogeology.

The Barnwell low-level radioactive solid waste burial site is located in Barnwell County, South Carolina, 5 miles west of the city of Barnwell. Approximately 1,050 feet of stratified gravel, sand, silt, clay, and limestone, ranging in age from Late Cretaceous to Holocene, underlie the burial site. Ground water within the study area occurs under water table, semi-confined, and artesian conditions. Overland flow and most precipitation that recharges the ground-water system at the burial site is discharged to Marys Branch Creek. This creek originates as a spring about 3,000 feet south of the burial site and flows to the southwest into lower Three Runs. Lower Three Runs discharges into the Savannah River. Waste shipments to the site were reduced from 200,000 cubic feet per month for the period 1971 to 1979 to 100,000 cubic feet per month by October 1981. The wastes consist of both nonfuel cycle and nuclear fuel-cycle wastes. The standard trench dimensions at the burial site are 100 feet wide by 1,000 feet long and 22 feet deep. Trench bottoms are a minimum of 5 feet above the water table. Seven soil mapping units occur at the waste disposal facility. The three major soil types are all well drained and cover approximately 84 percent of the study area. (USGS)
W86-02862

EFFECTS OF COAL MINING ON THE WATER QUALITY AND SEDIMENTATION OF LAKE TUSCALOOSA AND SELECTED TRIBUTARIES, NORTH RIVER BASIN, ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 5C.
W86-02863

EFFECTS OF SURFACE COAL-MINE RECLAMATION ON STREAM QUALITY IN A SMALL WATERSHED NEAR NELSONVILLE, SOUTHEASTERN, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
S. M. Hindall.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4179, 1984. 28 p, 6 fig, 3 tab, 9 ref.

Descriptors: *Strip mines, *Land reclamation, *Water quality, Surface water, Coal mines, *Ohio, Hocking County.

Abandoned surface coal mines in southeastern Ohio have caused degradation of the area's water resources. A study was undertaken in 1981 to determine the effects of abandoned-mine reclamation on water quality in the 'Yost tract' near Nelsonville, Ohio. Data on streamflow, water quality, and sedimentation were collected in Yost Run during reclamation of the Yost tract. In addition, some prereclamation and postreclamation data were collected. Analysis of the data indicates that there has been very little change in the chemical quality of Yost Run 10 months after reclamation; pH remains low, about 3.0-4.2, whereas specific conductance continues to be high, about 1,000-2,600 microhos per centimeter (at 25C). Concentrations of sulfate and dissolved iron also show no appreciable change, remaining about 550-1,800 milligrams per liter and 1,300 - 17,000 micrograms per liter, respectively. The sediment yield for Yost Run is 2,830 tons per square mile per year. The results indicate only that the effects on water quality have not been detected during this short study. Additional data collection is needed to observe changes in water quality. (USGS)
W86-02867

SUMMARY OF URBAN-RUNOFF STUDIES IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
S. R. Ellis, and M. H. Mustard.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4072, 1985. 31 p, 3 fig, 8 tab, 32 ref.

Descriptors: *Colorado, *Urban hydrology, *Urban runoff, Tributary basins, *Land use, *Rainfall, *Storm loads, Nutrients, Water quality, Load analysis, Denver.

The Denver metropolitan area has been the subject of urban-runoff studies for several years. The first studies, started in about 1968, usually were concerned only with the quantity of urban runoff. In 1974, studies were begun that included both quantity and quality of urban runoff. In 1979, Denver was selected as one of the cities to be included in the Nationwide Urban Runoff Program. The Denver study was called the Denver Regional Urban Runoff Program and was a cooperative study between the Denver Regional Council of Governments and the U.S. Geological Survey. This report presents the major conclusions of the pre-Denver Regional Urban Runoff Program studies and a summary of the various elements of the Denver Regional Urban Runoff Program. The report summarizes and references urban-runoff studies in the Denver metropolitan area and is a reference guide for planners and other persons interested in urban runoff. (USGS)
W86-02875

EFFECTS OF APPLIED WASTEWATER ON GROUND-WATER QUALITY AT FORT CARSON MILITARY RESERVATION NEAR COLORADO SPRINGS, COLORADO,
Geological Survey, Pueblo, CO. Water Resources Div.
P. Edelmann.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4268, 1984. 32 p, 12 fig, 4 tab, 15 ref.

Descriptors: *Groundwater quality, Nitrogen degradation, Applied wastewater, Land treatment, *Land disposal, Water pollution sources, Fort Carson Military Reservation, Colorado Springs, *Colorado.

Fort Carson Military Reservation has used treatment wastewater for irrigation of the Fort Carson golf course since 1971. The effect of applied wastewater on groundwater quality at Fort Carson golf course was evaluated using water levels and water-quality data from 20 observation wells. The water-quality constituents analyzed included dissolved solids, major ions, nutrients, detergents, dissolved organic carbon, chemical and biological oxygen demand, and trace elements. Effects of the applied wastewater on ground-water quality for most constituents were obscured by large areal variations and by high concentrations of the constituents upgradient from the golf course. The sources of nitrogen observed in the ground water beneath the golf course were applied wastewater, applied fertilizer, leachate from the organic-rich shale, and from unknown upgradient sources. Nitrogen loading at the golf course from wastewater and applied fertilizer was estimated to be 18,900 pounds per year. After 10 years, less than 1 percent of the nitrogen applied was actually present in the ground water. Loss of nitrogen to the atmosphere as nitrous oxides, absorption, and to fixation by grass resulted in the much smaller concentrations observed in the ground water. (USGS)
W86-02877

QUALITY OF GROUND WATER IN AGRICULTURAL AREAS OF THE SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO,
Geological Survey, Pueblo, CO. Water Resources Div.
P. Edelmann, and D. R. Buckles.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4281, 1984. 37 p, 11 fig, 4 tab, 24 ref.

Descriptors: *Water quality, *Groundwater, *Nitrites, *Nitrates, Groundwater contamination, Water pollution sources, *Colorado, San Luis Valley, Center, Rio Grande County, Alamosa County, Saguache County, Conejos County.

The quality of ground water in the principal agricultural areas of the San Luis Valley, south-central Colorado was evaluated using chemical analyses of water collected from 57 wells completed in the unconfined aquifer and from 25 wells completed in the confined aquifer. Ground water in both aquifers generally contains dissolved-solids concentrations of less than 500 milligrams per liter. In most areas, calcium is the principal cation in the ground water. Nitrite plus nitrate concentrations expressed as nitrogen, are generally less than 1 milligram per liter. However, the quality of ground water in certain areas may pose health and agricultural hazards. Water in the unconfined aquifer near Center contains high nitrite plus nitrate as nitrogen concentrations. The highest measured concentration in this area was 33 milligrams per liter. Water containing more than 1 milligram per liter of nitrite as nitrogen, or 10 milligrams per liter nitrate, as nitrogen, poses a potential health hazard for infants and should not be used for drinking. In addition, dissolved-solids concentration in the ground water in some areas is greater than 500 milligrams per liter and, if used for irrigation may reduce crop yields. (USGS)
W86-02878

RECONNAISSANCE OF WATER-QUALITY CHARACTERISTICS OF STREAMS IN THE CITY OF CHARLOTTE AND MECKLENBURG COUNTY, NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
W. H. Eddins, and J. K. Crawford.

Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-4308, 1984. 105 p, 24 fig, 27 tab, 24 ref.

Descriptors: Water quality, *Stream degradation, *Trace elements, *Nutrients, *Bacteria, Water pollution sources, Non-point sources, Point sources, *North Carolina, Charlotte, Mecklenburg County.

In 1979-81, water samples were collected from 119 sites on streams throughout the City of Charlotte and Mecklenburg County, North Carolina, and were analyzed for specific conductance, dissolved chloride, hardness, pH, total alkalinity, total phosphorus, trace elements, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, silver, and zinc and biological measures including dissolved oxygen, biochemical oxygen demand, fecal coliform bacteria, and fecal streptococcus bacteria. Sampling was conducted during both low flow (base flow) and high flow. Several water-quality measures including pH, total arsenic, total cadmium, total chromium, total copper, total iron, total lead, total manganese, total mercury, total silver, total zinc, dissolved oxygen, and fecal coliform bacteria at times exceeded North Carolina water-quality standards in various streams. Runoff from non-point sources appears to contribute more to the deterioration of streams in Charlotte and Mecklenburg County than point-source effluents. Urban and industrial areas contribute various trace elements. Residential and rural areas and municipal waste-water treatment plants contribute high amounts of phosphorus. (USGS)
W86-02879

SEAWATER INTRUSION INTO COASTAL AQUIFER IN WASHINGTON, 1978,
Geological Survey, Tacoma, WA. Water Resources Div.
N. P. Dion, and S. S. Sumioka.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. Washington State Water-Supply Bulletin, 56, 1984. 13 p, 2 fig, 14 plates, 2 tab, 12 ref.

Descriptors: *Saline water intrusion, *Groundwater, Water quality, *Washington, Chlorides, Sea water.

The extent and severity of seawater intrusion in Washington was determined using chloride data from 1,289 wells in 14 counties of coastal Washington in 1978. In addition, comparisons were made of chloride concentrations in 680 wells sampled both in 1966-68 and in 1978 to determine long-term trends of intrusion. Seawater-intrusion conditions in 1978 were similar to those detected in the late 1960's; for the most part, intrusion continued to be only a local problem. Many of the counties surveyed in 1978, such as Clallam, Jefferson, Pierce, Thurston, and Whatcom Counties, had several areas of severe but localized intrusion. Chloride concentrations in other counties, such as Island and San Juan Counties, were moderately high throughout the coastal areas and suggest a more widespread problem. Many of the individual wells that yielded high-chloride water in the late 1960's had been abandoned or destroyed by 1978. Comparisons of chloride data from 1966-68 and 1978 indicate that, in general, concentrations decreased slightly. This decrease, however, could reflect seasonal differences caused by pumping patterns or climatic changes. (USGS)
W86-02882

CHEMICAL QUALITY OF GROUND WATER IN YOLO AND SOLANO COUNTIES, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02884

GEOHYDROLOGY AND GROUND-WATER QUALITY MONITORING NETWORK FOR THE LOWER MOJAVE RIVER VALLEY, CALIFORNIA,
Geological Survey, Santee, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02888

SUMMARY OF STATISTICAL AND TREND ANALYSES OF SELECTED WATER-QUALITY DATA COLLECTED NEAR THE BIG THICKET NATIONAL PRESERVE, SOUTHEAST TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
F. C. Wells, and K. C. Bourdon.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-Filee Report 85-183, 1985. 11 p, 1 fig, 3 tab, 3 ref.

Descriptors: *Statistical analysis, *Water quality, Streamflow, Dissolved solids, *Texas, Dissolved oxygen, Biochemical oxygen demand, Nutrients, Trend analyses, Major ions, Minor elements, Indicator bacteria, Big Thicket National Preserve.

Statistical and trend analyses of selected water-quality data collected at three streamflow stations in the lower Neches River basin, Texas, are summarized in order to document baseline water-quality conditions in stream segments that flow through the Big Thicket National Preserve in southeast Texas. Dissolved solids concentrations in the streams are small, less than 132 milligrams per liter in 50 percent of the samples analyzed from each of the sites. Dissolved oxygen concentrations in the Neches River at Evadale (08041000) are generally large, exceeding 8.0 milligrams per liter in more than 50 percent of the samples analyzed. Total nitrogen and total phosphorus concentrations in samples from this site have not exceeded 1.8 and 0.20 milligrams per liter, respectively. Trend tests for dissolved solids and major ions indicate that small down-trends in total alkalinity, dissolved calcium, and hardness occurred in the Neches River at Evadale (08041000) and Pine-Island Bayou near Sour Lake (08041700). Small uptrends in dissolved sulfate were detected at all three stations in the study area. (USGS)
W86-02893

HYDROLOGY OF A SURFACE COAL MINED AREA IN RANDOLPH COUNTY, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
J. V. Borghese, and A. R. Klinger.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4256, 1984. 36 p, 9 fig, 7 tab, 19 ref.

Descriptors: *Coal mines, *Strip mines, Hydrologic aspects, *Surface water, *Groundwater, Water quality, Coal mining effects, *Illinois, Randolph County, *Water pollution sources.

Ground water was monitored from October 1980 to April 1983 and surface water was monitored from October 1980 to September 1982 in the 0.6-square-mile basin of Plum Creek Tributary in Randolph County, Illinois, to determine effects of surface mining for coal. During the study period, the basin was being surfaced mined. The mine pit advanced about 100 feet into the basin every month, reducing the basin's drainage area from an initial area of 0.6 square mile in October 1980 to 0.2 square mile in May 1982. The average daily flow of Plum Creek Tributary was 0.49 cubic foot per second. Periods of no flow occurred 18 percent of the time. Total recoverable iron at Plum Creek Tributary exceeded the Illinois Environmental Protection Agency's (IEPA) effluent standards. Mining activity may have been the cause. Ground-water levels of nine wells declined during the monitored period. The largest was a 35-foot decline in 16 months. Ground-water samples had dissolved-solids concentration that exceeded the IEPA's limit for potable supply for all geohydrologic units except the unconsolidated sand. Chloride concentrations exceeded IEPA's limits in all bedrock units except for a limestone unit. (USGS)
W86-02897

GEOHYDROLOGY OF THE CENTRAL MESILLA VALLEY, DONA ANA COUNTY, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02898

RECONNAISSANCE OF GROUND-WATER RESOURCES IN THE LOWER GUNNISON RIVER BASIN, SOUTHWESTERN COLORADO,
Geological Survey, Grand Junction, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02902

ESTIMATED WATER AND NUTRIENT INFLOWS AND OUTFLOWS, LAKE COCHITUATE, EASTERN MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
F. B. Gay.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4315, 1985. 59 p, 15 fig, 18 tab, 38 ref.

Descriptors: *Nitrogen, *Phosphorus, Surface runoff, Groundwater movement, *Runoff volume, Water budget, Hydrologic budget, *Lakes, *Water quality, Eutrophication, Precipitation, *Water pollution sources, *Nutrient loads, Water volumes, Lake Cochituate drainage basin, Sudbury River drainage basin, *Massachusetts.

Streamflow was the major source of water and nutrients (nitrogen and phosphorus) to Lake Cochituate, followed by ground water, and then precipitation during April 1978 through March 1979. Compared to all sources during that period, streams contributed 7,217 million gallons (a little over 82 percent) of water, 63,000 pounds (between 50 and 60 percent) of nitrogen, and 3,000 pounds (94 percent) of phosphorus. A little over 60 percent of all the water that entered Lake Cochituate flowed from Fisk Pond. This single source transported about 38,000 pounds of nitrogen and 2,000 pounds of phosphorus. Ground-water inflow to Lake Cochituate occurs along its shoreline except at the north end of Lake Cochituate's North Pond where natural seepage from the lake is occurring and at locations on the lake's Middle and South Ponds where municipal wells induce infiltration of lake water amounting to 1,228 million gallons for that period. Discharge of ground water to the lake was estimated to range from 462 to 816 million gallons and transported from 31,000 to 55,000 pounds of nitrogen and from 46 to 82 pounds of phosphorus. Bulk precipitation was estimated to contribute about the same volume of water to the lake as ground water but double its phosphorus load. However, the load of nitrogen, 8000 pounds, from bulk precipitation was the smallest of any source. (USGS)
W86-02904

RECONNAISSANCE EVALUATION OF CONTAMINATION OF THE ALLUVIAL AQUIFER IN THE EAST POPLAR OIL FIELD, ROOSEVELT COUNTY, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
G. W. Levings.
Available from: OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4174, 1984. 29 p, 10 fig, 4 tab, 12 ref.

Descriptors: *Groundwater, Water quality, *Brine disposal, *Groundwater pollution, Observation wells, Surface water, Data collections, *Montana, Poplar River Valley, Poplar River, East Poplar oil field, *Oil field wastes, *Water pollution sources.

Water moving from north to south in the alluvial aquifer of the Poplar River valley becomes contaminated with sodium chloride in the area underlain by the East Poplar oil fields. Four types of ground water were identified in the study area. Type 1 is sodium bicarbonate water. Type 2 is sodium chloride water with varying quantities of

calcium and magnesium. Type 3 water contains sodium and chloride in significantly larger concentrations than Type 2. Type 4 water is the brine being injected into brine-disposal wells. Contamination of the alluvial aquifer is indicated by a brine-freshwater interface in the alluvium, by downstream increase in chloride concentration of the Poplar River, and by downstream change in water type of the Poplar River. Contamination also may be indicated by the distribution of iron and manganese concentrations in water from wells near a brine-disposal well. Possible sources of sodium chloride contamination in the alluvium are brine-disposal wells, pipelines, and storage or evaporation pits. The contamination can occur from leaks in the casing of disposal wells or in pipelines caused by the corrosive nature of the brine or from storage or evaporation pits that have been improperly sealed or have sustained tears in the sealing material. (USGS)
W86-02915

WATER-QUALITY INVESTIGATIONS OF THE JORDAN RIVER, SALT LAKE COUNTY, UTAH, 1980-82,
Geological Survey, Salt Lake City, UT. Water Resources Div.
D. W. Stephens.
Available from: OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4298, 1984. 45 p, 13 fig, 10 tab, 30 ref.

Descriptors: *Dissolved oxygen, Trace elements, *Coliforms, Streptococcus, *Pesticides, *Turbidity, Suspended soils, Water quality, *Utah, Jordan River, Salt Lake County, Urbanization.

Water-quality studies were conducted on the Jordan River, Utah, to investigate specific problems: dissolved oxygen, toxic substances, sanitary quality, and turbidity and suspended sediment. The dissolved oxygen decreased from 8 milligrams per liter at the Jordan Narrows to less than 5 milligrams per liter at 500 North Street. Chemical oxygen demand increased about 23 percent and biochemical oxygen demand increased 90 percent. Nearly 78 percent of the water samples analyzed for total mercury exceeded the State intended-use standard of 0.05 microgram per liter. Concentrations of ammonia, cadmium, copper, lead, and zinc exceeded the standards periodically. The pesticides DDD, DDE, DDT, dieldrin, methoxychlor, and 2,4-D were occasionally detected in bottom materials. Most were present in quantities of less than 15 micrograms per kilogram. Concentrations of three indicator bacteria (total coliform, fecal coliform, and fecal streptococcus) increased in a downstream direction. Concentrations of total coliform bacteria often exceeded 5,000 colonies per 100 milliliters and concentrations of fecal coliform bacteria often exceeded 2,000 colonies per 100 milliliters. The primary sources of turbidity in the Jordan River are Utah Lake and discharges from the wastewater-treatment plants. Large values of turbidity were measured at the Jordan Narrows with a summer mean value of 88 nephelometer turbidity units (NTU) and a winter mean value of 43 NTU. (USGS)
W86-02916

5C. Effects Of Pollution

ATTENUATION OF LEACHATE GENERATED FROM CO-DISPOSAL OF VOLCANIC ASH AND SOLID WASTE,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
K. E. Hartz, S. K. Bhagat, L. A. Starlin, H. V. Mott, and K. R. Krivanek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-203990/AS, Price codes: A11 in paper copy, A01 in microfiche. Washington Water Rsearch Center Pullman, Report No. 60, May 1984. 254 p. 9 fig. 47 tab. 180 ref. C-00226. 14-34-0001-1457(1).

Descriptors: Volcanoes, Landfills, *Solid waste, Heavy metals, *Leachates, Groundwater pollution, Lysimeters, *Volcanic ash.

This project was performed in two parts. Part I consisted of analysis of the leachate character that was generated when volcanic ash and refuse were placed together in a landfill environment. Part I further considered the migration of metal through selected soil columns. Since heavy metals were of concern relative to leachate contamination, a separate study of leachate heavy metal removal was performed. Due to minimum surplus leachate generation from the lysimeters, coupled with some time constraints, conventional landfill leachate samples from a 'new' and an 'old' landfill were obtained and investigated. Part II of the investigation extended the scope beyond that which was proposed. Part I of the study described the leachate character from a codisposal landfill while Part II was an analysis of the feasibility of leachate treatment, in the event that heavy metals were a problem. The results are such that they may be applicable to leachate problems from landfills other than just those in which co-disposal is occurring. In general, the results of Part I indicate that the presence of volcanic ash will attenuate landfill leachate contamination, but may contribute to higher concentrations of selenium, lead, chromium, and arsenic.
W86-02432

EVALUATION OF NITROGEN AND PHOSPHORUS ENRICHMENT USING IN SITU ENCLOSURE BAGS WITH TEMPORAL INDIGENOUS PHYTOPLANKTON POPULATIONS,
Arkansas Univ., Fayetteville. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 2H.
W86-02449

TOXICOLOGICAL STUDIES ON AQUATIC CONTAMINANTS ORIGINATING FROM COAL PRODUCTION AND UTILIZATION: THE INDUCTION OF TOLERANCE TO SILVER IN LABORATORY POPULATIONS OF FISH AND THE CHRONIC TOXICITY OF NICKEL TO FISH EARLY LIFE STAGES,
Kentucky Water Resources Research Inst., Lexington.
W. J. Birge, J. A. Black, J. F. Hobson, A. G. Westerman, and T. M. Short.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214666/AS, Price codes: A03 in paper copy, A01 in microfiche. Research Report No 151, August 1984. 33 p, 2 fig, 9 tab, 35 ref. USGS G-844-02.

Descriptors: Aquatic environment, Aquatic populations, Toxins, Fish, Fish toxins, Mortality, Silver, Nickel, *Coal mining wastes, *Toxic wastes.

Aquatic toxicity studies were performed on two important coal-derived contaminants, silver and nickel. Silver was investigated with regard to metal-induced tolerance in laboratory populations of the fathead minnow (Pimephales promelas). Fish were exposed to acute silver concentrations following acclimation to sublethal exposures of this metal. Based on median lethal times (LT50), animals which had received 14 days prior to exposure to 1.5 and 15 micrograms Ag/L were three to four times more resistant to silver than were previously unexposed organisms. This metal-induced resistance was not a sustained response. After organisms which had been acclimated to 15 micrograms/L had been transferred to clean water for two weeks, LT50 values determined with these animals were statistically indistinguishable from those calculated with non-acclimated control fish. With respect to nickel, a 32-day continuous-flow test was performed with the fathead minnow. Nickel was administered in duplicate at six exposure concentrations ranging from 0.038 to 0.733 mg/L in medium-hard water (100 mg CaCO3/L). Animal test responses included mortality, teratogenesis, and growth. Based on frequencies of mortality after 32 days of continuous exposure, significant effects were recorded at a nickel concentration of 0.120 mg/L, and the no observed effect concentration (NOEC) was determined to be 0.057 mg Ni/L.
W86-02470

EFFECTS OF GRAVEL EXTRACTION ON THE MEADE RIVER AT ATQASUK, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
For primary bibliographic entry see Field 5B.
W86-02475

MERCURY IN PEAT AND ITS DRAINAGE WATERS IN EASTERN NORTH CAROLINA,
Duke Univ., Beaufort, NC. Marine Lab.
For primary bibliographic entry see Field 5A.
W86-02485

EFFECTS OF DISINFECTION TECHNIQUES ON CHESAPEAKE BAY SEDIMENTS,
Maryland Univ., Solomons. Chesapeake Biological Lab.
A. D. Uhler, S. M. Baksi, C. B. Daniels, and J. C. Means.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214849, Price codes: A04 in paper copy. A01 in microfiche. Maryland University, College Park, Water Resources Research Center, Publication No. 82, September, 1983. 49 p, 6 tab, 17 fig, 38 ref. USGS G847-03.

Descriptors: *Maryland, *Chesapeake Bay, *Disinfection, *Chlorination, Ozonation, *Sediments, Toxicity, Water pollution effects, Toxic wastes.

This report describes the chemical reactivity of Chesapeake Bay sediments with dissolved chlorine, and assesses the products of chlorination for potential mutagenicity. At pH 7, and 0% salinity the average chlorine demand of Potomac River sediment was 0.07 mole HOCl/mole adsorbed organic carbon. Trihalomethanes (THM) were produced upon chlorination, the speciation of which are a complex function of salinity. Along the salinity gradient 0-30%, THM production reaches a maximum at 5% salinity, then rapidly falls off with increasing salinity. Patapsco River sediments were found to contain both frameshift and base-pair substitution mutagens, with a higher level of mutagenic activity associated with sediments collected from a highly industrialized portion of the river. At lower chlorine concentrations, chlorine treatment caused an increase in mutagenic activity in some sediments. At higher concentrations, this relationship was masked by cytotoxicity.
W86-02487

IMPACT OF POINT AND NON-POINT NUTRIENT ENRICHMENT ON THE DYNAMICS OF NATURAL PHYTOPLANKTON,
Maryland Univ., Solomons. Chesapeake Biological Lab.
C. F. D'Elia, J. G. Sanders, and W. R. Boynton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214856, Price codes: A04 in paper copy, A01 in microfiche. Maryland University, College Park, Water Resources Research Center, Publication No. 83, September, 1983. 50 p, 6 tab, 16 fig, 17 ref. USGS G847-05.

Descriptors: *Nutrients, Enrichment, *Phytoplankton, *Maryland, Species composition, Productivity, Oxygen requirements, Nitrogen, Phosphorus, Cultures, Eutrophication, Seasonal variability.

0.5-m3 outdoor, continuous cultures, innoculated with indigenous phytoplankton from the Patuxent River estuary, Maryland were used in a series of bioassay experiments to determine nutrient enrichment potential. Biomass increased in response to the addition of a growth-limiting nutrient in the form of NO-3, NH+4, or PO4 3- to the 1.0-um filtered river water contiuously supplied to the cultures at 0.5 culture volumes/day. During the warmer, low flow seasons, NH+4 addition typically enhanced phytoplankton growth in experiments lasting two weeks each. During the late winter, high flow season, PO4 3- addition enhanced phytoplankton growth, but owing to low solar irradiance, levels of biomass reached were less than at other seasons. Replicability between triplicate tanks was excellent; biomass levels in them typically were within 20% of each other.

The results suggest that concomitant with great seasonal variability in nutrient supplies and concentrations in the river is great variability in the probable response of indigenous phytoplankton to additional nutrient enrichment. The information gained in this project should have relevance to understanding the effects of nutrient inputs to the Patuxent River.
W86-02488

ACID PRECIPITATION: SOURCE IDENTIFICATION AND ITS EFFECTS ON WATER QUALITY,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W86-02491

ACUTE EFFECTS OF ALUMINUM AND ACIDITY UPON NINE STREAM INSECTS,
New Hampshire Univ., Durham. Dept. of Zoology.
J. F. Haney, and W. Cook.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214948/AS, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, New Hampshire Water Resources Research Institute, Curham, Research Report No. 46, Sept 1984. 33 p, 10 fig, 1 tab. USGS G856-03.

Descriptors: *New Hampshire, *Water pollution effects, *Acid rain, *Aluminum, Stream insects, Stream drift, Aluminum toxicity, Insect mortality, *Hydrogen ion concentration.

The effects of increased aluminum concentrations and decreased pH upon the larval stages of five caddisflies, two mayflies, a stonefly, and a beetle were tested. These insects were removed from two riffle habitats in southern New Hampshire, placed into artificial streams and subjected to additions of aluminum salts and sulfuric acid for a three-day period. Acute mortality and the drifting behavior over this three-day period were then analysed using multiple linear regression. Aluminum additions caused increased mortality in the stonefly Nemoura nigratta and the caddisfly Macronema spp.; aluminum additions also increased the drift of the caddisfly Potamia flava, but the response was small and likely due to the increased salinities in aluminum treatments. Aluminum, hydrogen ions, and their interaction affected the drifting behavior of the water penny beetle, Psephenus herricki. While concentrations of aluminum and hydrogen ions did not affect the drift of the mayfly Stenonema spp., high variability of aluminum concentrations caused increased drift for this genus; Macronema spp. also showed increased drift in response to large variations in aluminum concentrations. The effect of aluminum upon molt success was minor, but the effect of high acidity upon molt success was pronounced.
W86-02497

WATERSHED INTERACTIONS AFFECTING POND ACIDIFICATION,
New Hampshire Univ., Durham. Water Resources Research Center.
For primary bibliographic entry see Field 2K.
W86-02498

ACID PRECIPITATION IN THE WASHINGTON CASCADES, PHASE II,
Central Washington Univ., Ellensburg. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W86-02513

INTRAGRAVEL BEHAVIOR OF SALMONID ALEVINS IN RESPONSE TO ENVIRONMENTAL CHANGES,
Washington Univ., Seattle. Fisheries Research Inst.
D. E. Fast, and Q. J. Stober.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215127/AS, Price codes: A06 in paper copy, A01 in microfiche. Technical Completion Report FRI-UW-8414, Washington Water Resources Research Institute, Pullman, December 1984. 116 p, 28 fig, 21 tab, 108 ref. USGS G876-04.

Descriptors: *Salmon, Trout, Growth, Fish eggs, Water level fluctuations, *Fish behavior, *Water pollution effects, *Environmental effects, *Washington.

The purpose of this research was to study the morphologic development, survival, and behavior of chum, coho, and chinook salmon, and steelhead trout alevins from hatching through yolk absorption. The ability of alevins to respond adaptively to conditions of environmental stress was determined and a comparison of responses between species was made. The metabolic rates of chum, coho, and steelhead alevins were measured with a respirometer. All three species increased the amount of oxygen consumed per gram of total dry weight from hatching through yolk absorption. The LT50's of alevins subjected to single, long-term dewaterings were directly related to time in days after hatching. The decrease in survival time was attributed to increased metabolic rate and decreased yolk sac size. The highly vascularized yolk sac surface acted as a secondary respiratory organ when gill respiration was limited due to dewatering. Downware intragravel movement of alevins occurred within 48 hours of hatching under conditions of adequate velocity, dissolved oxygen, and darkness. The differences in number of alevins moving was attributed to size. Alevins of all four species demonstrated poritive rheotaxis by migrating into the current. Photobehavioral studies indicated that negative photoresponses increased as morphological development progressed. A transition from photonegative to photopositive behavior occurred before initiation of emergence from the gravel in each species. The transition to photopositive behavior was most rapid in chinook alevins, intermediate in chum and coho, and slowest in steelhead trout.
W86-02515

BIOLOGICAL NEUTRALIZATION OF ACID DEPOSITION IN OMBROGENOUS AND MIEROTROPHIC WETLANDS,
Massachusetts Univ., Amherst. Water Resources Research Center.
T. P. Army, and H. F. Hemond.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216901/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, Massachusetts Water Resources Research Center, Publication No. 149, Amherst, January, 1985. 47 p, 3 fig, 5 tab, 42 ref, 2 append. USGS G848-03.

Descriptors: *Wetlands, *Bogs, *Sulfur, *Sufates, *Acid deposition, *Pore water *Acid rain, *Mass transfer, *Marshes, Stauration, Watersheds, Hydrology, Chemical analysis, *Massachusetts, Quabbin Reservoir, Bickford Reservoir.

The magnitude of net neutralization of atmospherically deposited acid in an ombrogenous wetland ecosystem was assessed using ion chromatographic analysis of the porewaters, laboratory incubations for sulfate and nitrate uptake under oxic and anoxic conditions, and lead-210-based deposition rates for solid sulfur species, together with rigorous statistical treatment of porewater data and an annual-averaged mass transport model for sulfate. Results indicate a biologically-dominated sulfate distribution exists in the primary study site, with nearly complete transformation of sulfate deposition within centimeters of the bog/atmosphere interface. The major product appears to be a solid phase organic sulfur species having a very long residence time in the wetland. In addition, a measurable amount of soluble organic sulfur is produced. By contrast, porewater chemistry at a second study site, a minerotrophic marsh, failed to show evidence of significant long-term sulfate transformation. It is hypothesised that hydrologic differences are responsible for the observed differences in behavior of the two systems. While the ombrogenous site remained essentially saturated throughout the year, the minerotrophic site may have experienced some desaturation, resulting in reoxidation of sulfur.
W86-02521

EFFECTS OF ACIDITY ON TREE POLLEN GERMINATION AND TUBE GROWTH,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
D. M. Van Ryn, and J. S. Jacobson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216976/AS, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, August 1984. 24 p, 4 tab, 1 fig, 18 ref. USGS G859-04.

Descriptors: *Pollen germination, *Pollen tube growth, *Acid rain, Northeastern hardwoods, Pollution effects, *New York.

Most of the northeastern hardwood forests in North America are exposed repeatedly to acidic rainfall at pH values below 5.0. Pollen germination, tube growth and fertilization, important parts of the reproductive process, are sensitive to changes in their chemical environment. Accordingly, we investigated the effects of acidity on pollen germination and tube elongation of four northeastern species, flowering dogwood, black birch, yellow birch, and sugar maple. Pollen was collected and germinated in a growth medium that was acidified to pH values ranging from 5.0 to 2.6. Pollen was found to be sensitive to acidification of the germination medium to below pH 4.2. At pH 3.0 and 2.6 no pollen germinated in any species. Between pH values 4.2 and 3.4, percent germination was reduced by over 50% from that at pH 5.0. Mean tube length was reduced at the lowest pH at which germination occurred. The pH of the growth medium increased during pollen germination to at least 5.2 when initial pH values were 3.8 and above. These results suggest that acidic rain that now occurs in eastern North America may influence reproductive processes that are necessary for seed set and regeneration in northern hardwood forests.
W86-02528

USE OF INDUCED FLUORESCENCE MEASUREMENTS TO ASSESS ALUMINUM-ORGANIC INTERACTIONS IN ACIDIFIED LAKES,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
W. D. Philpot, J. J. Bisogni, and A. Vodacek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216984/AS, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, August 1984. 18 p, 10 fig, 15 ref. USGS G859-05.

Descriptors: *Acid rain, *New York, *Pollutant identification, Fluorescence measurements, Laser fluorosensing, Remote sensing, Dissolved organic matter, Aluminum, Acidified lakes.

Aluminum, which can be highly toxic in the free state, is often innocuous when associated with the dissolved organic substances (humic substances) common to natural waters. This is of particular significance in the acidified lakes of the Adirondack region of New York State since metals, notably aluminum, lose their attraction for the organics at lower pH. Natural fluorescence of the humic substances may provide a tool for monitoring aluminum. The characteristic fluorescence is reduced (quenched) when trace metals are associated with the organics. Laboratory experiments were conducted using both natural water samples and samples prepared in the Laboratory, in which fluorescence of humic substances was observed for varying concentrations of metals and at several pH levels. Fluorescence quenching was observed with the addition of Al, Fe, and Cu. Variations in pH also affected the quenching. In the absence of metal ions, the quenching effect was negligible. When metal ions (Al) were present the quenching effects of pH were more pronounced. Results suggest that the use of remote sensing to monitor aluminum-organic interactions is feasible although several important problems concerning interference of other metals and pH effects remain to be explored.

W86-02529

EFFECTS OF ACID PRECIPITATION ON COMPOSITION, ELECTROKINETIC BEHAVIOR, CATION ADSORPTION AND ION EXCHANGE CAPACITY IN VARIOUS SOIL SYSTEMS,
Tennessee Water Resources Research Center, Knoxville.
A. R. Bowers, and T. Higgs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217727/AS, Price codes: A05 in paper copy, A01 in microfiche. Research Report No. 103, September 1984. 82 p, 45 ref, 23 fig, 6 tab, 2 append. USGS G870-03.

Descriptors: *Acid rain, Ion exchange, Adsorption, Soil environment, Cations, Iron oxides, Hydrogen ion concentration, *Tennessee, *Water pollution effects.

The effects of acidic environments on the physical/chemical behavior of natural soils from Tennessee was examined in the laboratory. Primarily, the influence of increased weathering of iron oxides on electrokinetic behavior, cation exchange capacity and adsorption of 'free' and complexed heavy metals was studied. Natural soils, compared to samples in which iron oxides were removed showed little change in cation exchange capacity or electrokinetic behavior. Acid aging of one particular soil was also conducted. Studies showed that prolonged exposure to acidic environments may result in drastic changes in soil properties. Substantial changes in the electrokinetic behavior were found with the zero point of charge increaisng from a pH of 2.0 for the unaged soil to 8.0 for the acid aged one. Also, the zinc adsorptive behavior of the soils changed significantly with acid aging. This study indicates that prolonged exposure to acidic environments may create changes in physical/chemical properties of soils rich in iron oxides.
W86-02537

NUTRIENT ASSIMILATION CAPACITY OF SHALLOW COASTAL LAKES,
Louisiana Water Resources Research Inst., Baton Rouge.
R. D. DeLaune, C. J. Smith, W. H. Patrick, and M. N. Sarafyan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-219004/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, August 1984, 62 p, 3 tab, 28 fig. USGS G845-02.

Descriptors: *Louisiana, Water quality, *Nonpoint source pollution, *Nutrient cycling, Nitrification-denitrification, Toxic organics, Sedimentation, P adsorption, Chlorophyll, Freshwater lakes.

Nitrogen and phosphorus cycling in relation to the trophic state of coastal freshwater lakes was studied. Nonpoint source nutrient inputs, as well as sediment-interstitial and lake water nitrogen and phosphorus fluxes, were measured seasonally. Sedimentation rates in the lake were determined using Cs-137 dating. Levels of toxic organics and fate of 2,4-D in the water bodies were determined. Phosphorus and nitrogen levels in the lake were found to be largely dependent on concentrations in the incoming bayou water from upland drainage. Nitrogen fixation on the order of 20-30 Hg/g/yr was measured. C-14 uptake studies indicated appreciable assimilation of nitrogen and phosphorus by phyto-plankton. Laboratory equilibrium studies showed bottom sediments in the lake are a major sink for the incoming dissolved orthophosphate phosphorus. Total nitrogen concentrations in water draining into the lake generally exceeded concentrations in the lakes. N-15 balance studies along with in situ and in vivo denitrification studies showed that the bottom sediment of the lakes remove appreciable nitrogen via nitrification-denitrification processes. Sedimentation ranged from 1.1 cm/yr to 1.8 cm/yr. Even though the lake is eutrophic the sediment served as a buffer by removing large amounts of nitrogen and phosphorus through sedimentation processes. Levels of toxic organic in the lakes were low. The herbicide 2,4-D which enters these lakes was found to be rapidly adsorbed from the water column by bottom sediment. The sediment oxidation-reduction potential influenced its degradation rate with degradation being considerably slower under anaerobic conditions. Results indicate that any increase in nutrient loading to the lakes has the potential to further aggravate the eutrophication problem.
W86-02547

EFFECTS OF POLLUTION ON GROWTH OF MIDWESTERN MUSSEL SHELLS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
G. D. Rosenberg, and M. T. Henschen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225878/AS, Price codes: A02 in paper copy, A01 in microfiche. Technical Report No. 168, August 1984. 13 p, 7 ref. USGS G841-05.

Descriptors: *Mussels, *Bioindicators, *Indiana, Water pollution effects, Mississippi River, Wisconsin.

Exporters of freshwater mussel shells to the Japanese cultured pearl industry report that stains within the inner shell layers are appearing with increasing frequency. Chemical (electron microprobe) analyses of the stains suggest that the stains are due to pollution, and that mussel shells may be useful indicators of water quality. Although several species of mussels from several Midwestern states (including Indiana, Illinois, Wisconsin, Minnesota, and Iowa) were studied the focus of this report is the Threeridge (Amblema plicata) from the Minnesota--Wisconsin--Iowa area of the Mississippi River between LaCrosse and Prairie du Chien, Wisconsin. Chemical analyses reveal the presence of aluminum and silicon (clay minerals) in the stains, confirming previous suggestions that mussels are sensitive to turbidity. But the presence of unusual amounts of iron, phosphorus, sulfur, chlorine and perhaps even magnesium, nickel, sodium, and potassium point to the increased deleterious effects that a combination of pollutants can have in a synergistic system. Here, increased turbidity due to increased river traffic or farming combined with metal pollutants results in the metals being concentrated by adsorption to the clay minerals. Grossly unnatural phosphorus and sulfur concentrations in the shell indicate a consequent disturbance of calcium physiology.
W86-02563

EVALUATION OF NON-POINT POLLUTION CONTROL PRACTICES AND COPPER TREATMENTS ON CONTROL OF NUISANCE FILAMENTOUS ALGAE,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5G.
W86-02564

EFFECT OF WATER QUALITY ON THE UPTAKE AND LOSS OF BIOLOGICALLY IMPORTANT ORGANIC AND INORGANIC CHEMICALS BY ORGANISMS,
California Univ., Davis. Water Resources Center.
J. H. Swinehart, and J. H. Crowe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225894/AS, Price codes: A02 in paper copy, A01 in microfiche. Technical Completion Report, California Water Resources Center, Davis, January 1985, 12 p. USGS A-083-CAL.

Descriptors: *Pollutants, *Contamination, *Heavy metals, *Amino acids, *Carbohydrates, *Organic pesticides, Water quality, Acids, Metals, Absorption, Chemicals, Bioindicators, *California.

The objectives of this work are to measure the effects of water contaminants such as heavy metals, acids, and organic pesticides on influxes of glycine into and effluxes of amino acids, carbohydrates, and metal ions from membranes of marine and freshwater organisms, and to use these results to measure changes in water quality. The general conclusions reached from this work concerning the use of membrane fluxes to measure water quality are the following: First, for freshwater and marine organisms having an active transport process for the influx of an amino acid such as glycine, a deterioration in water quality due to the introduction of heavy metal ions, acid or organic contaminants results in the uptake of glycine. Second, for freshwater organisms, effluxes of the divalent cations Ca(+2) and Mg(+2) are enhanced by heavy metal ions and acid at low concentrations indicating reduced membrane stability which ultimately results in the loss of amino acids. Third, Hg(+2) compounds at extremely small concentrations cause large losses of amino acids from both marine annd freshwater organisms, and the observation of large amino acid losses from organisms in natural waters is a measure of Hg(+2) contamination. (Snyder-California)
W86-02565

TEMPERATURE REQUIREMENTS OF PACIFIC COASTAL STREAM FISHES,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
P. B. Moyle, and N. K. Knight.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225928/AS, Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center Completion Report, Sept. 1984, 30 p, 10 fig, 4 tab, 47 ref. G830-03.

Descriptors: *Temperature effects, *Temperature, *Fish, *Trout, *Sculpin, *Sucker, *Perch, *Habitat, Streamflow, Streams, Water depth, Velocity, *California.

The importance of temperature in regulating the abundance and distribution of fishes has been well-documented, although primarily for species from the eastern United States and Canada. Three sets of experiments were used to define the thermal niches of Pacific Coastal fishes - acute temperature preferences, routine metabolic rates, and critical thermal maxima. Plots of standard deviations of preferred temperatures at each acclimation temperature provided an estimate of the relative activity of each species, both intraspecifically and interspecifically. Routine metabolic rates were highest and most variable for squawfish, and most gradual (with increasing temperatures) for hardhead. Critical Thermal Maxima (CTM) generally increased with increasing acclimation temperatures for each species. Man-made alterations, such as diversion dams, channelization, or removal of riparian vegetation can change stream thermal regimes that reduce the efficiencies of these fish activities, or in extreme cases, threaten their survival. Along with temperature changes from these alterations are usually changes in oxygen levels of the water, which may be stressful to the resident species. The critical thermal maxima can be used to detect sublethal doses of pollutants or the presence of disease before mortalities occur. (Snyder-California)
W86-02568

DEVELOPMENT OF FREQUENCY FUNCTIONS FOR URBAN NON-POINT SOURCE RISK EVALUATION,
Catholic Univ. of America, Washington, DC. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-02575

PHYTOPLANKTON CONTROL AND WATER QUALITY IMPROVEMENT THROUGH MANIPULATION OF ANIMAL COMMUNITIES,
Nebraska Univ.-Lincoln. Dept. of Forestry, Fisheries and Wildlife.
G. L. Hergenrader.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227189/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, Nebraska Water Resources Center, Lincoln, September 1984. 24 p, 5 tab, 7 ref. USGS G854-03. 14-08-0001-G854.

Descriptors: *Nebraska, *Plankton control, Water quality control, Water quality, *Eutrophication, *Predation, *Water clarity, Zooplankton, Phytoplankton, Biomanipulation, Piscivore, Planktivore.

This was a pilot study to demonstrate the feasibility of improving water quality in surface waters by enhancing natural zooplankton grazing on phytoplankton through manipulation of fish communities. Piscivorous northern pike (Esox lucius) were introduced to two eutrophic farm ponds in eastern Nebraska containing large populations of planktivorous black crappie in an effort to evaluate the effects of controlled planktivore predation on zooplankton and phytoplankton communities. Data collected from this treatment were compared to previous research on these ponds when they either lacked a fish population, contained only planktivorous black crappie, or contained both black crappie and northern pike. The stocking of piscivorous northern pike in the study ponds resulted in a marked decline in the immature black crappie densities of both ponds. This predation pressure was supplemented by wash-out of crappie during spring rains which caused both ponds to release water. As black crappie densities were reduced, a shift in the species composition and size distribution of the zooplankton community was observed in both ponds; as rotifers were reduced in dominance and crustacean zooplankton became prevalent. Concurrent with this shift in zooplankton community structure was a slight increase in overall water clarity, supporting our hypothesis concerning enhanced water quality. However, phytoplankton biomass reached higher levels throughout the year in both ponds, as compared to previous years.
W86-02583

DEVELOPMENT OF A CHLOROPHYLL MONITORING PROGRAM FOR WATER SUPPLY RESERVOIRS USING IN VIVO FLUORIMETRY,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5F.
W86-02661

MICROBIAL SURVIVAL IN CURED MUNICIPAL COMPOST,
New Hampshire Univ., Durham.
G. R. Zamarchi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249068/AS, Price codes: A05 in paper copy, A01 in microfiche. A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Microbiology, September 1982. 84 p, 10 fig, 13 tab, 1 append, 23 ref. B-006-NH.

Descriptors: *Sewage, *Sewage bacteria, *Sludge, *Municipal wastes, *Composting, *Survival, Salmonella, Coliforms, Streptococcus, Fungi, Aspergillus fumigatus.

Two studies were conducted to assess factors affecting survival of salmonellae in cured municipal compost. In the first study, Salmonella heidelberg was seeded into finished compost and finished compost mixed with soil. These seeded samples were monitored for salmonellae survival over a six-month period. Fecal coliforms and fecal streptococci were monitored to evaluate their usefulness as indicators of salmonellae survival. At the same time, pH, moisture content, and the survival of a fungus, Aspergillus fumigatus, were measured. The bench scale study was an attempt to measure the effect of different quantities and qualities of soil on salmonellae survival by varying the amounts and type of soil in seeded compost/soil mixtures, as well as the effect of temperature. As part of this study, fecal coliforms, fecal streptococci, pH, and moisture content were also measured. The results show that competition from indigenous fecal coliforms and fecal streptococci accounted for the inability of salmonellae to survive in the field experiments. This competition was absent from the bench scale studies. Lack of survival under the bench scale conditions can be attributed mainly to desiccation. The indicator organisms appeared to have no practical application as such under either field or bench scale conditions. The A. fumigatus population remained constant throughout the study. The changes in pH, temperature, or quantity and type of soil present had no discernible effect.
W86-02685

EFFECTS OF SUSPENDED SEDIMENTS ON STREAM INVERTEBRATE DETRITAL PROCESSING AND BIOENERGETICS,
Idaho Univ., Moscow. Dept. of Plant, Soil and Entomological Sciences.
M. A. Brusven, and C. E. Hornig.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249142/AS, Price codes: A03 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute, Moscow, Completion Report, May, 1984. 22 p, 4 fig, 4 tab, 27 ref. USGA G839-02. 14-08-0001-G839.

Descriptors: *Aquatic insects, *Suspended sediments, Growth, Feeding rates, *Water pollution effects, Idaho.

The effects of suspended sediments on stream invertebrate detrital processing and bioenergetic parameters were investigated in replicated, light and temperature-controlled chambers in the laboratory. The leafshredding insects Pteronarcys californica and Hesperophylax occidentalis were studied. Mean daily ingestion rates were less among test insects than control insects for seven of the eight trials. In five of the eight trials, mean ingestion rates were suppressed by >41% when compared to insects held in 0.0 g/1 suspended sediment environments. Feeding inhibition was typically greater at the end of the feeding trials (14 days) than at the beginning (0-4 days). Growth of the immature feeding stage of the insects studied in both test and control environments for all trials combined was negligable when compared to their ingestion rates. Mean daily growth rates ranged from -1.2% to 1.6% of the mean daily ingestion rates. The mean assimilation efficiencies of second-year naiads of P. californica were 17.4% and 21.3% when subjected to 3.0 g/1 and 0.0 g/1 suspended sediment concentrations, respectively.
W86-02693

TRANSFER OF INFORMATION AND TECHNOLOGY ON ACID MINE DRAINAGE FROM RESEARCH TO THE USER,
West Virginia Univ., Morgantown. Water Research Inst.
For primary bibliographic entry see Field 5B.
W86-02711

EFFECTS OF IRON IN STREAMS ON GILL MORPHOLOGY, OXYGEN CONSUMPTION, AND PHYTOPLANKTON/BENTHIC INVERTEBRATE DISTRIBUTION,
West Virginia Univ., Morgantown. Water Research Inst.
E. C. Keller, D. E. Hinton, D. K. Werner, R. B. Gerber, and A. J. Becker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101326/AS, Price codes: A08 in paper copy, A01 in microfiche. Completion Report, 1984. 163 p, 53 fig, 71 tab, 48 ref. USGS G877-202. 14-08-0001-G877.

Descriptors: *West Virginia, *Acid mine drainage, Iron, Water quality standards, *Ecological effects, Fish, Benthic fauna, Bioassay, Histology, Pathology, Phytoplankton, Aquatic life, Invertebrates, Ecology, Ecosystems, Manganese, Chemical properties, Acidity, Oxygen, Water pollution effects.

This project covered many aspects of the influence of iron on aquatic organisms at a four-tier level: cellular, phytoplankton, invertebrate, and fish. One other section dealt with the statistical distribution of total iron in the waters of West Virginia. The iron content of the waters, along with manganese and conductivity, were associated with mucous cell structure changes in trout perch and bluntnose minnow. Iron, along with pH was associated with changes in the mucous-cell structure of the creek chub. Iron, with pH and total hardness, was strongly associated with the total numbers of phytoplankton in the waters. Iron, along with pH and dissolved oxygen, was associated with the total numbers of fish. An iron/acidity index of the waters studied was strongly associated with a diatom phytoplankton index and the 'Tenmile Creek' and the 'high diversity' benthic invertebrate indices. Higher iron levels were found to increase oxygen consumption rates in the amphipod Gammarus minus. Finally, the average level of iron and the frequency of exceeding the 1 mg/L total iron water quality limit in natural waters were both found to be dependent upon the region of the state from which the water samples were obtained. Overall, about 30 percent of the time, the 1 mg/L regulatory limit was exceeded from water sampled throughout the state.
W86-02713

EFFECTS OF COAL MINING ON THE WATER QUALITY AND SEDIMENTATION OF LAKE TUSCALOOSA AND SELECTED TRIBUTARIES, NORTH RIVER BASIN, ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
E. F. Cole.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4310, 1985. 53 p, 34 fig, 4 tab, 23 ref.

Descriptors: *Water pollution sources, *Water pollution effects, *Lakes, *Mine drainage. Water quality, *Sedimentation, Limnology, Reservoir deposition, Water quality standards, *Alabama, North River basin.

Lake Tuscaloosa, a reservoir on North River, is the primary source of water supply for the city of Tuscaloosa, Alabama, and surrounding areas. Between October 1982 and September 1983, 14 sites in the North River basin were sampled to determine if surface coal mining has impacted the quality of water in the lake and selected tributaries. Water draining mined basins showed increases in specific conductance, sulfate concentrations, and dissolved and total recoverable iron and manganese concentrations after mining started in 1975. Although water in the reservoir has become more mineralized with only an estimated 5 percent of the basin mined, total dissolved solids concentrations are still very low, ranging from 28 to 35 milligrams per liter at the dam. The quality of water at most sites was, except for pH, iron, and manganese, within secondary drinking water standards. The pH of water from streams draining either mined or unmined basins was generally less than 6.5. Sedimentation has occurred at most measured lake cross sections since impoundment. However, natural factors such as steep overland and channel slopes, may cause more sedimentation in the lake from unmined basins than from coal mining in a different basin. (USGS)
W86-02863

ESTIMATED WATER AND NUTRIENT INFLOWS AND OUTFLOWS, LAKE COCHITUATE, EASTERN MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02904

5D. Waste Treatment Processes

DESTRUCTION OF HAZARDOUS WASTES BY ULTRAVIOLET CATALYZED OXIDATION,
Connecticut Univ., Storrs. Inst. of Water Resources.
D. W. Sundstrom, and H. E. Klei.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-265090, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, September 1984. 18 p, 7 fig, 11 ref. USGS G832-02. 14-08-0001-G-832.

Descriptors: *Chemical degradation, *Ultraviolet radiation, Hazardous materials, *Oxidation process, Ultraviolet catalyzed oxidation, *Wastewater treatment, *Benzene, Hydrogen peroxide.

Conventional wastewater treatment processes are ineffective on many hazardous organic compounds found in domestic water supplies and industrial wastes. This project investigated the destruction of benzene in water by ultraviolet catalyzed oxidation with hydrogen peroxide. The reactions were conducted in a tubular flow reactor equipped with a low pressure mercury lamp to provide the ultraviolet radiation. The course of the reactions with time were followed by analyzing for benzene with a gas chromatograph and for hydrogen peroxide by a colorimetric method. The rate of disappearance of benzene increased with increasing hydrogen peroxide concentration and ultraviolet light intensity but was relatively insensitive to temperature. Starting with 10-15 ppm benzene, concentrations were reduced below 50 ppb in 35-60 min reaction time.
W86-02421

INVESTIGATION OF METHODS FOR THE IMPROVEMENT OF THE ABSORPTION FREEZE PILOT PLANT OPERATION,
Burns and Roe Industrial Services Corp., Paramus, NJ.
A. C. F. Ammerlaan, and A. Ko.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-128759, Price codes: A08 in paper copy, A01 in microfiche. Completion Report August 1984, 102 p, 19 tab, 7 fig, 3 app. C-3001-S. 3-CR-93-00040(1).

Descriptors: *Desalination, *Absorption Freezing, Absorption Freezing Vapor Compression, *Waste Heat, Waste Heat Absorption Freezing, Pilot Plant, Absorbents, Heat Transfer, Energy Consumption, Commercial applications.

The operational experience and the present condition of the Absorption Freezing Vapor Compression (AFVC) Pilot Plant in Wrightsville Beach, NC, were reviewed in order to develop methods that would improve efficiency and reliability. The mechanical components of the AFVC plant that are restricting the AFVC plant performance were identified and solutions were proposed. The possibilities of operating the plant with different absorbents and with waste heat were explored and established. The present absorbent consists of a 15% sodium chloride solution. Lithium chloride and tri- or tetra ethylene glycol were investigated for their potential as new absorbents. Glycol solutions allow operation in the 100 - 120F range thus allowing the use of waste heat and operation in the Waste Heat Absorption Freezing (WHAF) mode. A comprehensive heat transfer calculation method was developed to determine the effects of the higher viscosity of clycol solutions on heat transfer rates. Both the AFVC and WHAF process were reviewed for their commercial potential by reviewing the specific energy consumption and their applicability for desalination, waste effluent treatment and food processing. If waste heat is available the WHAF process could be a very attractive process for waste effluent treatment and the production of process water.
W86-02422

INVESTIGATION OF POSSIBLE CYCLES OF CONCENTRATION IN INDUSTRIAL COOLING TOWERS USING VARIOUS COMBINATIONS OF TREATMENT PROCESSES TO RENOVATE MUNICIPAL WASTEWATER FEED,
Montgomery (James M.), Inc., Pasadena, CA.
M. D. Umphres, G. P. Treweek, R. R. Trussell, and J. S. Gregg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-128767, Price codes: A10 in paper copy, A01 in microfiche. Report No. OWRT/RU-83-9, January 1984. 151 p, 78 fig, 20 tab, 2 append. OWRT C-90139-R. 14-34-0001-9459(1).

Descriptors: *Water reuse, *Wastewater renovation, Cooling water, Corrosion, Scaling, *Cooling towers.

The objective of this investigation was to demonstrate the use of reclaimed secondary effluent as makeup to industrial cooling towers. The raw wastewater was treated by low pH lime precipitation, activated sludge aeration, secondary clarification, and filtration. This effluent was pumped through sodium ion exchangers to remove divalent cations, particularly calcium, then treated internally within the cooling tower loop with either an acid-chromate or alkaline-inhibitor program. The effectiveness of the two internal treatment programs was compared with each other and with a baseline program which provided no additional pretreatment. The acid-chromate program was the most successful in the three principal areas of concern: low corrosion rates for mild steel (0.5 mpy) and admiralty brass (0.1 mpy) heat exchangers, no mineral scaling up to 10 cycles of concentration, and good germicidal efficiency of chlorine as evidenced by minimal biological fouling. The alkaline-inhibitor program was acceptable under certain conditions: corrosion rates for admiralty brass were low (0.1 mpy) but unacceptable for mild steel (10 mpy); no mineral scaling was evident up to 10 cycles of concentration; although biological fouling was not observed, the plate counts in the alkaline program were one to two orders of magnitude higher than the acid program. The baseline program was the least acceptable of the three tested: corrosion rates for admiralty brass were low (0.1 mpy) but unacceptable for mild steel (10 mpy); mineral scaling (zinc phosphate) built up on the deposit monitors; the germicidal efficiency of the added chlorine was good at the neutral pH 7.0 with no evidence of biological fouling.
W86-02423

INDUSTRIAL WATER REUSE WITH COUPLED-TRANSPORT MEMBRANES,
Bend Research, Inc., OR.
W. C. Babcock, J. W. Brooke, D. T. Friesen, D. R. Kamperman, and E. D. LaChapelle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-203925/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, January 1985, 27 p, 15 fig, 3 tab, 7 ref. BuRec C-10142-R(1). 14-34-0001-2403.

Descriptors: *Metal-Finishing wastes, *Water reuse, Wastewater treatment, *Plating waste, *Rinse water, *Polymeric membranes, Chrome plating, Chromic acid.

The objective of this program was to demonstrate the feasibility of using coupled-transport membranes to treat chrome-plating rinse waters. A major effort was directed toward field tests of a hollow-fiber membrane unit at a decorative-chrome plating shop. Membrane development aimed at improving chromium fluxes was also conducted. Field tests at Bend Plating, Inc., of Bend, Oregon were conducted using a unit containing modules with 15 sq ft of membrane area. This unit was used to recover chromium from the second rinse tank of a three-rinse counterflow system. Two types of modules were tested; the liquid membranes in one module contained Adogen 383 as the chromium complexing agent in an aromatic diluent, while the membranes in the remaining two modules contained Alamine 336 as the chromium complexing agent in an aliphatic diluent. The membrane module containing Adogen 383 operated for 100 days at an average flux of about 2.5 lb sq ft -year. The modules containing the Alamine 336 operated with an average flux of about 1.5 sq ft - year. One of these Alamine 336 modules accumulated 370 days of operating time. Two methods were investigated for converting sodium chromate--the chromium salt produced in the coupled-transport process--to chromic acid. This conversion would permit recycle of the chromium to the plasting bath. One method, relying on Donnan dialysis, was found to be unacceptable, primarily because the chromic acid produced was not sufficiently pure. On the other hand, cation exchange with conventional resins produced a pure chromic acid concentrate that could be returned to the plating bath.
W86-02425

OPTIMIZATION OF HOLLOW FIBER ULTRAFILTRATION MEMBRANE TYPE AND SYSTEM DESIGN FOR WASTEWATER REUSE IN THE TEXTILE INDUSTRY,
Romicon, Inc., Woburn, MA.
R. Breslau, and A. Fuchs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-203933, Price codes: A08 in paper copy, A01 in microfiche. Completion Report, (1984) 120 p, 24 tab, 53 fig, 7 ref. 14-34-0001-8803.

Descriptors: *Membranes, *Ultrafiltration, *Textile water reuse, Waste water treatment, Membrane processes, Separation techniques.

A year long study was conducted to evaluate the application of hollow fiber ultrafiltration for treatment and suubsequent reuse of wastewater at several major textile mills. Water jet looms effluent, batcher water effluent, untreated composite effluent and final (post-biologically treated) composite effluent streams were all tested during the pilot program. The results of both the water jet looms and batcher water effluent pilot programs suggested good technical potential. The use of hollow fiber ultrafiltration for the processing of these streams produced a treated stream greatly reduced in the contaminant species believed to restrict successful reuse. Economic evaluations of processes incorporating hollow fiber ultrafiltration are presented. At one plant, the major costs involved in water treatment are incurred by the waste treatment facility. The bulk of controlled contaminant species are introduced through relatively small (volume) streams such as the batcher water effluent. Substantial cost savings could result from segregated treatment of these streams if the large volume of remaining effluent could be discharged with reduction in, or elimination of, further treatment. Untreated composite and final composite effluent streams were tested at two locations during this study. The results of these tests indicated that hollow fiber ultrafiltration removed substantial amounts of contaminant species. The low molecular weight organic species and salts, not removed by ultrafiltration, were considered to be disadvantageous to most dyeing operations. In at least one case (acetate dyeing) the treated stream was considered acceptable for reuse. Good future potential is expected in the application of ultrafiltration for advanced waste treatment.
W86-02426

COST-EFFECTIVE DESIGN AND OPERATION OF URBAN STORMWATER CONTROL SYSTEMS: DECISION-SUPPORT SOFTWARE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. W. Labadie, N. S. Grigg, D. M. Morrow, and D. K. Robinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-203941/AS, Price codes: A10 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Fort Collins, Completion Report No. 135, October, 1984, 205 p, 14 fig, 4 tab, 54 ref, 4 append. OWRT 90037-U. 14-34-0001-0507(2).

Descriptors: *Storm wastewater, *Combined sewers, *Control systems, Computer programs, *Optimization, *Urban runoff, Forecasting, Dynamic programming, Hydraulic models, *Sewer systems, *Design, Cost analysis.

Although the microcomputer revolution has made powerful computer hardware available at low cost, there is still a severe lag in the availability of computer software that can aid urban water managers in finding cost-effective solutions to complex design and operational problems in stormwater and combined sewer control. A Stormwater Control Package (SWCP) is presented with user manual for introducing automation into urban stormwater control systems. The package contains state-of-the-art technology in storm inflow forecasting, fully dynamic hydraulic routing, and dynamic programming optimization. It is designed for 'simulated' real-time experimentation on application of automation to storm and combined sewer control for achieving improved performance. In addition, it is believed that application of the SWCP at the planning level can potentially save large amounts of capital in sizing of facilities through optimum regulation in real-time of storage and conveyance of

stormwater. Computational experience with the North Shore Outfalls and Channel Outfalls Consolidation projects of the Clean Water Program of San Francisco is presented. In addition to operational software, an optimal sewer design package called CSUDP/SEWER is presented with user manual which also employs dynamic programming. As a screening tool, Program CSUDP/SEWER can find least-cost vertical layouts and sizings of storm drainage systems. Preliminary experience with an optimal horizontal layout procedure which combines nonlinear programming, network flow theory and CSUDP/SEWER is also presented, but more testing with large networks is needed for this algorithm.
W86-02427

HIGH RATE ANAEROBIC TREATMENT OF EVAPORATOR CONDENSATE FROM SPENT PULPING LIQUORS,
Washington Univ., Seattle. Dept. of Civil Engineering.
M. M. Benjamin, J. R. Ferguson, J. L. McCarthy, and N. L. Ricker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-203974/AS, Price codes: A11 in paper copy, A01 in microfiche. Technical Completion Report, March 1984. 234 p, 58 fig, 24 tab, 17 ref. B-084-WASH(2). 14-34-0001-0256.

Descriptors: *Anaerobic digestion, *Pulp wastes, Biodegradation, Toxicity, Acclimatization, Washington condensates, Wastewater treatment, Fermentation, Methane, Evaporators.

A study of the anaerobic treatment of several pulp and paper waste streams has demonstrated the degree of organic removal and concomitant methane production possible at verying organic loading rates. Evaporator condensate from the sulfite pulping process can be treated alone or with waste from the caustic extraction stage of bleaching. The neutralization requirement for those waste streams has been evaluated theorectically and empirically; toxicity and biodegradability of wastes and individual compounds have been evaluated in batch anaerobic bioassays. Pulse loading studies were conducted. Sulfur in the evaporator condensate has been shown to be partially reduced to sulfide and to reduce COD removal efficiency and methane production. Preliminary cost estimates for application of anaerobic treatment in a packed bed system have been completed for sulfite and kraft process evaporator condensates.
W86-02430

OPERATION OF A CRYSTALLIZATION PILOT PLANT ON METAL PLATING WASTE STREAMS AT NAVAL AIR REWORK FACILITY (NARF), NORFOLK, VA - PHASE 1 & 2A,
Heist Engineering Corp., Walnut Creek, CA.
J. A. Heist, K. M. Hunt, and P. J. Wrobel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-204022/AS, Price codes: A04 in paper copy, A01 in microfiche. Final Report, Oct. 1984. 51 p, 9 tab, 11 fig, 3 ref. Bu Rec 3-CR-93-00030.

Descriptors: *Water reuse, *Industrial wastes, *Water reclamation, *Electroplating, Crystallization, Freeze crystallization, *Wastewater treatment, Freezing.

Metal plating rinse water reclamation by a freeze crystallization process is being investigated in a program sponsored through an interagency agreement between the Naval Air Propulsion Center, the Norfolk Naval Air Rework Facility (NARF), and the Bureau of Reclamation's Office of Water Research. This report presents the history of the program, describes the technology and its application to the industrial wastes in the military, and outlines the current status of the program and its future plans.
W86-02435

INVESTIGATIONS OF THE MODES OF CONTAMINANT CAPTURE IN CGA (MGD) FOAMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
F. Sebba.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211704/AS, Price codes: A03 in paper copy, A01 in microfiche. OWRT/RU-82/10, 1982. 41 p, 10 fig, 3 tab, 7 plates, 7 ref. C-00069-R(1). 14-34-0001-0489.

Descriptors: *Wastewater treatment, *Flotation, *Bubbles, *Colloids, *Flocculation, Industrial wastewater, Foam separation, Surfactants, Aluminum, Iron compounds, Calcium compounds, Soap, Oil recovery.

A laboratory method for generating colloidal gas aphrons (CGA), which are dispersions of very small bubbles in water, is described. The bubble sizes were measured in a flow-through cell using a TV camera and microscope. Bubbles under 25 microns in diameter rapidly diminished until they became invisible; those larger than 25 microns were much more stable and only disappeared in creaming. Using graphite as a typical fine particle, flotation occurred by attachement to the exterior of the CGA, rather than by penetration of the bubble as in conventional flotation. Addition of flocculant, usually a polyvalent cation, was necessary. This collected the small particles in a floc which was buoyed to the surface as a whole. It was presumed that some larger particles were buoyed by invisible bubbles. Optimum conditions for flotation of oils (using kerosene as an example) and of dissolved ions (calcium, ferric, aluminum) are discussed. Nonionic surfactant was useful in oil flotation; pH control produced precipitation flotation in the metallic ion flotation.
W86-02441

USE OF MICROCOMPUTERS TO AID WASTEWATER TREATMENT PLANT OPERATIONS,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
D. G. Parker, and S. C. Parker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211738/AS, Price codes: A05 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project Completion Report. Pub. No. 105, September, 1984. 77 p, 42 fig, 18 ref. USGS G-829-24.

Descriptors: *Wastewater treatment, *Database management, *Microcomputers, Relational databases, *Arkansas.

This report presents the development of a microcomputer based data management system for wastewater treatment plants. The relational database model was shown to be well suited for data management applications in wastewater treatment plants. A general data management system was developed for use with a microcomputer using a commercially available relational database management system. Use of the developed system requires no special computer training. The system was tailored for use at the wastewater treatment plant at Springdale, Arkansas. The capabilities of the system were demonstrated with actual data from the Springdale plant.
W86-02444

FACTORS AFFECTING THE REMOVAL OF SUSPENDED AND DISSOLVED SOLIDS IN HIGH STRENGTH WASTEWATER FROM VEGETABLE PROCESSING,
Arkansas Univ., Fayetteville. Dept. of Food Science.
W. A. Sistrunk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211761/AS, Price codes: A04 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project Completion report, Pub. No. 108, Sept. 1984. 58 p, 17 tab, 7 fig. USGS G-829-06.

Descriptors: *Wastewater treatment, *Food processing wastes, Suspended solids, Dissolved solids, Total dissolved solids, Effluent, Wastewater, Wastewater strength, Treatment systems, Turbidity, Polymers, Inorganic salts, Flocculating agents, Coagulating, Arkansas.

Fifty or more individual factorial experiments were designed to study the effectiveness of physical-chemical and micro-biological treatments in removal of suspended and dissolved solids in effluent from potatoes, hominy, dry beans and other vegetables. The wastewaters were obtained from local processing plants and treated with 3 to 5 inorganic salts, 13 polymers, and 3 or more pH levels during 12 months. Also, selected strains of yeast and fungi were used to assimilate the effluent. Individual inorganic salts were more effective on a certain vegetable effluent than others. Polymers (anionic and cationic) were more effective in coagulating suspended solids in combination with salts than either alone. Different polymers and concentrations of polymers in combination with salts were required for each effluent tested. Saccharonyces filbuliger was the most effective yeast for reducing total solids and chemical oxygen demand in potatoes. Actively fermenting systems were capable of 90% or more reduction after centrifugation. The fungi Neurospora sitophila and Trichoderma viride assimilated the total and dissolved solids more rapidly in effluents from potato and hominy processing than any of the other fungi studied.
W86-02447

MEMBRANE-ORGANIC PHASE OXIDATION PROCESS FOR THE DESTRUCTION OF TOXIC ORGANICS IN HAZARDOUS WASTEWATERS,
Kentucky Water Resources Research Inst., Lexington.
C. E. Hamrin, D. Bhattacharyya, and W. K. Glynn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214575/AS, Price codes: A05 in paper copy, A01 in microfiche. Research Report No 152, August, 1984. 73 p, 30 fig, 7 tab, 32 ref. USGS G-844-05.

Descriptors: Hazardous materials, Toxins, Oxidation, Wet oxidation process, Phenols, Pesticides, Herbicides, Membranes, Membrane processes, *Wastewater treatment, *Toxic wastes, *Phenols, *Coal mine wastes.

The examination of the extraction/oxidation of organic solutes in a two phase oxidation process was undertaken to discern the important parameters and the process mechanism of this system. Several parameters were adjusted to measure their effect on the disappearance rate of each organic from the water phase. The water to PFD volume ratio proved to be the most sensitive parameter affecting the disappearance rate, although temperature was also significant. Comparison with one phase oxidation systems demonstrated that the water/PFD system improved on the reduction of organics from the water phase. B-naphthol oxidation increased over 50% in a 2/6 water/PFD volume ratio compared with the water phase oxidation. Phenol, which had the smallest distribution coefficient of the three organics tested, showed a significant reduction rate in the two phase system which was greater than a water phase oxidation system operating at higher pressures. Naphthalene and an H-coal wastewater also showed more oxidation in the two phase system than in a single water phase system. These results show that two-phase oxidation is a viable process and testing of the total membrane-oxidation system is in order. The feasibility of membrane concentration step is also demonstrated with model organics and actual wastewaters.
W86-02461

IDENTIFICATION OF SOIL-WATER CHEMICAL PARAMETERS FOR THE PREDICTION AND TREATMENT OF SUSPENDED SOLIDS IN SURFACE WATER RESERVOIRS OF COAL MINE LANDS,
Kentucky Water Resources Research Inst., Lexington.
V. P. Evangelou, J. H. Grove, and R. I. Barnhisel.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB85-214773/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, July, 1984. 68 p, 19 fig, 21 tab, 33 ref. USGS G-844-04.

Descriptors: Suspended solids, *Sedimentation, Sedimentation basins, Spoil disposal, Colloids, Clay minerals, *Kentucky, *Water pollution control.

High concentrations of suspended solids in coal mine sedimentation ponds are a factor in lowering water quality. This study focuses on the influence dissolved solids have on concentration and settling of suspended solids. Water samples from sedimentation ponds in Eastern and Western Kentucky were used to evaluate water composition in such ponds. Spoil samples from surface mine sites in both parts of the state were used to evaluate water composition released from the spoils upon introducing water. The results demonstrate that water quality emanating from coal spoils of Eastern and Western coal mines is dependent on the type of spoil and/or geologic strate represented. Water composition of randomly selected sedimentation ponds revealed that the relationship between electrical conductance (EC) in mmhos/cm and ionic strength (I) of water is I = 0.012(EC). Furthermore, it was determined that there is a linear relationship between the repulsive index, RI (based somewhat loosely on double-layer theory), and suspended solids. Kinetic data on settling of suspended solids has shown that upon increasing the ionic strength of the water (consequently decreasing RI), the rate of wetting increased dramatically. The critical RI at which complete removal of all suspended solids, estimated by graphic extrapolation, is shown to be dependent on the percent base saturation. The data also demonstrate that the critical RI (RI at maximum flocculation) varies depending on the spoils mineralogical and chemical composition. The overall study shows that decreasing in suspended solids in coal mine sedimentation ponds can be done by small increases in ionic strength.
W86-02480

EVALUATION OF COMBINED SEWER OVERFLOW MANAGEMENT STRATEGIES THROUGH PIPE NETWORK COMPUTER SIMULATION,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5G.
W86-02505

EVALUATION OF A VEGETATIVE FILTER FOR DAIRY WASTEWATER TREATMENT IN SOUTHERN APPLACHIA,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
J. D. Barker, and B. A. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215036/AS, Price codes: A05 in paper copy, A01 in microfiche. Project Completion Report, North Carolina Water Resources Research Institute, Raleigh, December 1984. 69 p, 27 fig, 31 tab, 17 ref. USGS G860-07.

Descriptors: Economic aspects, *Dairy industry, *Animal wastes, *Nutrients, *Feedlot runoff, *Feedlot wastes, Nonpoint pollution sources, Wastewater management, Wastewater treatment, Fertilizers, Dairy farms, *North Carolina.

Runoff from dairy feedlots and exercise areas and milking center wastewaters, are widely recognized as potential point and nonpoint source pollutants. Cost-effective and easily managed alternative treatment methodologies need to be evaluated for application in rural mountain areas. The effectiveness of vegetative filter for treating feedlot runoff and milking center wastewaters was tested at a small mountain dairy farm. A shallow concrete settling basin (10' x 40' x 2') was constructed to receive all wastewater. Basin effluent was distributed onto a 0.6 acre filter area on 10% slope seeded to fescue, orchardgrass, and ryegrass. The filter was terraced to intercept and retard the overland flow velocity. Automated sampling stations measured the flow and collected representative samples of the wastewater influent to the settling basin and the filter effluent. Soil and forage samples were collected and analyzed for nutrients and salt. Results of the study indicate that 66% of the total rainfall was measured as paved lot runoff. An average 7.24 gallons of water per cow per day were used for milking center cleanup. Approximately 21,000 gallons of manure solids (7.6% TS) were removed from the settling basin and field spread. Solids settling efficiency of the basin was 41%. Only 5.3% of the total wastewater influent volume was discharged from the filter into the adjacent stream with filter organic, nutrient, and solids removal efficiencies ranging from 96.7% to 99%.
W86-02506

DEVELOPMENT OF THE NUTRIENT FILM TECHNIQUE FOR RENOVATION OF WASTEWATER FOR NONPOTABLE REUSE,
Florida International Univ., Miami. Drinking Water Research Center.
L. Handley-Raven, S. Casey, L. Lopez, H. Richards, and J. Cooper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217016/AS, Price codes: A04 in paper copy, A01 in microfiche. Final Report, May 1985. 59 p, 16 fig, 16 tab, 60 ref. USGS C-10030-R (1). 14-34-001-2406.

Descriptors: *Nutrient film technique, Para grass, Brachiaria mutica, Napier grass, Pennisetum purpureum, Water reuse, Wastewater treatment, Florida, Crop production, Pilot plants.

The specific goals of the project were: to construct a nutrient film technique (NFT) pilot plant, screen and select crop plants for use with an outdoor NFT in Florida, test the selected crops with both secondary effluent and raw wastewater, and to determine how to maximize the NFT's performance in terms of wastewater removals and crop production. Of the crops tested, only para grass (Brachiaria mutica) was suitable. Monitoring of the system removals revealed: (1) that grab sampling is an inadequate means of describing system performance; (2) that a gravel matrix was needed in the NFT channels; (3) that the crops were very sensitive in their responses to small daily weather changes; (4) that para grass uses ammonium-N better than nitrate-N; and (5) a possible need to acidify the wastewater. Testing of napier grass (Pennisetum purpureum) showed that it was unsuitable for outdoor NFT use. Neither secondary effluent nor raw wastewater was totally suitable for use with para grass; primary effluent is recommended. The investigators were unable to confirm an earlier reported plug-flow model for the NFT.
W86-02532

FUNDAMENTAL CONCEPTS OF AUTODIGESTION OF BIOMASS,
Delaware Univ., Newark. Dept. of Civil Engineering.
A. F. Gaudy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217719/AS, Price codes: A03 in paper copy, A01 in microfiche. Delaware Water Resources Research Center, Newark, Project Completion Report, 1984. 34 p, 10 fig, 15 ref. USGS G833/03.

Descriptors: *Aerobic digestion, *Biological oxidation, *Sludge disposal, Decomposing organic matter, Biological wastewater treatment, Organic wastes, *Activated sludge.

The purpose of the project is to draw together and analyze a large amount of previously unpublished experimental data obtained by the principal investigator. These data pertain to autodigestion of activated sludge and a possibly related phenomenon, the production and release of soluble organic materials during cell decay. Most of the first-year effort related to examination of the long-term fate of the 'residual' organic matter (measured as chemical oxygen demand, COD) remaining after aerobic treatment of a synthetic waste. Data were available for three long-term experiments (the longest run for 613 days) in which both the biomass and the residual COD from each daily feeding of the batch activated sludge were retained, totally, in the reactor. It was shown conclusively that over 90 percent of the so-called residual COD was metabolizabled by the biomass responsible for its production. It was also concluded that while long biomass retention times tend to decrease the specific decay rate, kd, an equilibrium value was attained; i.e., the decay rate did not approach zero.
W86-02536

BIOLOGICAL DETOXIFICATION OF HAZARDOUS WASTES,
Tennessee Water Resources Research Center, Knoxville.
J. W. Smith, and L. W. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217750/AS, Price codes: A04 in paper copy, A01 in microfiche. Research Report No. 104, September 1984. 62 p, 19 tab, 17 fig, 18 ref. USGS G870-02.

Descriptors: Hazardous materials, Organic wastes, Wastewater, *Wastewater treatment, Biological wastewater treatment, Activated sludge process; Heavy metals, Pesticides, *Tennessee.

This research focused on the potential for biological treatment of hazardous organic wastewaters using rotating biological contactors (RBC) modified to include an aeration basin and final clarifier with sludge recycle to the fixed-film media. These systems have been appropriately designated activated rotating biological contactors (ARBC). The research was designed to facilitate comparison of the ARBC system to a completely mixed activated sludge system with respect to treatability of hazardous organic wastewaters. Wastewaters examined were a medium-strength organic waste containing copper, a synthetic leachate containing heptachlor, chlordane, and endrin, a high-strength organic industrial waste, and a medium-strength organic waste containing hexavalent chromium. Compared to activated sludge systems, ARBC systems achieved higher organic removal efficiencies and, in addition, generally removed greater quantities of heavy metals and pesticides. The ARBC system also demonstrated greater capability to handle shock organic loadings as well as shock loadings of toxic substances.
W86-02540

SENSITIVITY ANALYSIS FOR AN ACTIVATED SLUDGE MODEL WHICH CONSIDERS TOXICANT CONCENTRATION,
Auburn Univ., AL. Dept. of Civil Engineering.
L. Benefield, and R. B. Reed.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217776/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, Alabama Water Resources Research Institute, Auburn, September 1984. 48 p, 6 fig, 5 tab, 9 ref. USGS G880-02.

Descriptors: *Activated sludge, *Toxicity, *Waste water treatment, *Mathematical models, *Alabama, Biological toxicity model, Floc radius, Oxygen utilization, Ammonia-nitrogen removal, Ortho-phosphate removal, Biomass production, Aggregated microbial suspension.

A mathematical model has been developed which describes organics removal, oxygen utilization, ammonia-nitrogen removal, ortho-phosphate removal and biomass production in an aggregated microbial suspension containing organics as a soluble biodegradable material, toxicants, and a uniform floc size. It is applicable to both steady state and transient conditions as well as to systems experiencing only carbon oxidation or both carbon oxidation and nitrification. In devleloping the model it was assumed that a lack of either organics, oxygen, ammonia-nitrogen, ortho-phosphate or any combination of these nutrients could limit the overall rate of the process and/or that the presence of toxicants could limit the rate of the process. The primary objective of this research was to perform a sensitivity analysis on the model. This analysis indicated that the single most important factor in determining model output (based on the effluent organics

concentration) is the retention time in the reactor. The second most important factor is the floc radius.
W86-02542

ENHANCED REUSE POTENTIAL OF COAL SLURRY TRANSPORT WATER: TOXIC ORGANICS ASSESSMENT AND REMOVAL (PHASE II),
Tennessee Univ., Knoxville. Dept. of Microbiology.
G. S. Sayler, R. A. Minear, M. C. Reid, and J. W. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-218063/AS, Price codes: A06 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, Knoxville, Technical Completion Report, Research Report No. 106, September 1985. 95 p, 24 fig, 20 tab, 80 ref. C-0200-R(1). 14-08-0001-G-1057.

Descriptors: *Slurries, *Water reuse, Waste water reclamation, Humic acids, *Chlorination, Coal slurry transport, Organic wastes, *Wastewater treatment, Organic carbon.

This research was conducted to evaluate organic water quality characteristics of raw and treated coal slurry wastewaters that effect potential reuse application of this water resource. The composition and biological treatability of the dissolved organic constituents of coal slurry transport wastewater was examined. In addition, the occurrence of environmental mutagens in the wastewater and potential for formation upon chlorination was determined. The results of the investigation demonstrated that the dissolved organic carbon constituents of the slurry wastewater were of humic material in origin and predominated by moderate to low molecular weight (>5000 MW to <1000 MW) fulvic and non-fulvic acid constituents. Chlorination of the wastewater resulted in the production of significant levels of chloroform primarily from fulvic acid precursor organics. However, non-volatile mutagenic agents were not detected in either raw or chlorinated slurry wastewaters. The results of this investigation demonstrate that renovation of coal slurry wastewater for potential reuse is attainable and that renovated wastewater from the perspective of the organic constituents may not pose adverse ecological or environmental health effects.
W86-02543

CONCURRENT REMOVAL OF TOXIC HEAVY METALS AND ORGANIC SUBSTANCES BY ACTIVATED CARBON PROCESS FROM CONTAMINATED GROUNDWATER,
Delaware Univ., Newark. Dept. of Civil Engineering.
C. P. Huang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-218972/AS, Price codes: A05 in paper copy, A01 in microfiche. Delaware Water Resources Research Center, Newark, Project Completion Report, 1984. 85 p, 61 fig, 4 tab, 35 ref. USGS G833/04.

Descriptors: *Activated carbon, Adsorption, Heavy metals, Toxic wastes, *Groundwater quality.

The treatability of groundwater containing both toxic heavy metals and organic substances was performed in the laboratory using synthetic solutions and activated carbon adsorption process. Two typical activated carbons, i.e., Nuchar SA (an L-type) and Filtrasorb 400 (an H-type) were selected. Three heavy metals, mercury (II), lead (II), and cadmium (II), and six organics, namely catechol, salicylic acid, sulfosalicylic acid, benzoic acid, phenol, and chloroacetic acid, were used in the preparation of synthetic water for experiment. The removability of heavy metals and organic substances was determined at different values of pH (2.5 - 10.5) and ratios of metal to organics (0:1, 10:1, 1:1, 1:10 and 1:0). The results show that L-carbon is superior for the removal of heavy metals and H-carbon is better for organic removal. The percent toxic substances removal is very high; 90 to 100% removal is achievable by proper selection of operational conditions. When heavy metals and organics are present concurrently, the removal of organics is not affected as long as the concentration (molar) of heavy metals is less than the organics except chloroacetic acid. Chloroacetic acid is not removable by either type of carbon in the absence of heavy metals. However, drastic improvement can be realized when a trace amount of heavy metal is present.
W86-02544

OPTIMUM TREATMENT FOR COAL PILE RUNOFF IN LOUISIANA,
Louisiana Water Resources Research Inst., Baton Rouge.
M. E. Tittlebaum, and P. I. Hendershot.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-219020/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, Baton Rouge, August 1984. 39 p, 4 tab, 8 fig, 26 ref. USGS G845-05.

Descriptors: *Coal, *Runoff, *Suspended solids, *Polymers, *Louisiana, Coagulation, Sedimentation basins, *Sedimentation rates, Electric powerplants, Polyelectrolytes.

The coming decades will see coal having an increasingly important role in Louisiana's economy, both as a fuel for production of electricity and as a bulk material to be stored and shipped through the lower Mississippi River. Coal storage facilities in south Louisiana are exposed to the nation's highest annual rainfall, resulting in significant quantities of runoff which must be contained and treated in accordance with state and federal guidelines. Effluent criteria must be met for pH and total suspended solids. Cationic organic polymers were used in laboratory settling tests to destabilize and flocculate a coal pile runoff suspension obtained from a power plant. It was found through column settling tests that the flocculated runoff suspension exhibited zone or hindered settling behavior. Essentially all of the suspended solids could be removed by flocculation with a 20 ppm dosage of cationic polymer and 20 minutes of quiescent settling. In the column settling tests, two methods of determining interfacial settling velocity were compared, with the respective results being used to calculate the area required for a clarification basin. It was concluded that coal pile runoff should be treated by a unit operation using a cationic polymer. Based on the results of combustion tests, it was concluded that the thickened sludge from such an operation may have value as an energy source.
W86-02549

DETERMINATION OF THE INHIBITORY GROWTH KINETICS OF NITRIFIERS IN BATCH AND CONTINUOUS FLOW REACTORS,
Delaware Univ., Newark. Dept. of Civil Engineering.
A. F. Rozich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225811/AS, Price codes: A03 in paper copy, A01 in microfiche. Delaware Water Resources Research Center, Newark, Project Completion Report, 1937. 40 p, 11 fig, 6 tab, 20 ref. USGS G833/07.

Descriptors: *Nitrification, Kinetics, Inhibition, *Wastewater treatment.

The purpose of this research was to investigate the nature of the functional relationship that exists between nitrifying microorganisms and exogenous ammonia concentration. A two-state continuous culture system which was fed a synthetic ammonia waste devoid in organic carbon was utilized to collect u versus S data for nitrifiers. These experiments showed that nitrifier growth kinetics should be quantified with a substrate inhibition growth model and not the Monod equation. The continuous flow nitrifier growth data were fit to the Haldane equatLon which resulted in values of 1.20 days-1, 2.7 mg/e, and 19.1 mg/e for Hmax, Ks, and Ki, respectively. Batch growth studies were also performed using biomass harvested from the continuous flow system. These tests were performed by inoculating the synthetic ammonia media with the biomass whence the ammonia concentration was monitored as a function of time; this data was fit to a batch growth model which incorporated the Haldane equation. The umax values determined with the batch data were much lower than those measured in the continuous flow unit. At this time, no explanation is offered to explain this discrepancy between the measured values of the continuous flow and batch growth constants; however, for field applications, the batch constants imply a more conservative operating range in which to achieve nitrification. It would seem appropriate that, in future work, consideration should be given to investigating this aspect of nitrification kinetics.
W86-02557

TREATMENT METHODS FOR REUSE OF MUNICIPAL SEWAGE EFFLUENT FOR MINERAL FLOTATION IN THE MINING INDUSTRY,
Arizona Univ., Tucson. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3C.
W86-02587

COMPARATIVE LABORATORY STUDY OF SEWAGE TREATMENT BY A CAPILLARY SIPHON TRENCH SYSTEM VERSUS A CONVENTIONAL LEACHING TRENCH SYSTEM,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
T. A. Dillaha, and W. J. Zolan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227320/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. 47, July 1983. 25 p, 5 fig, 2 tab, 5 ref. USGS G837-04.

Descriptors: *Guam, *Biological wastewater treatment, *Wastewater treatment, Domestic wastes, Aerobic treatment, Leachates, Nitrogen removal, Phosphorus removal, Chemical oxygen demand.

Laboratory tests were conducted to investigate the performance of the 'Niimi Process' or capillary siphon trench, a soil based wastewater disposal system common in Japan. The system is similar to conventional septic tank leaching field trenches except that the trenches are filled with capillary sand instead of gravel and the lower quarter of the trench is lined with an impermeable membrane. The capillary sand and impermeable membrane are used to induce unsaturated flow of wastewater through the upper soil profile, or zone of aeration, where maximum biological activity occurs. The Niimi Process was evaluated by constructing a laboratory scale Niimi Process trench and a conventional soil absorption trench. Synthetic wastewater characteristic of domestic sewage was then applied to the two trenches in two 14-week experiments. No statistically significant differences were found between the operation of the two systems except for NO3-N and Total-N removal during the second experiment where the Niimi trench was slightly more effective. Both reactors removed 99 percent of the applied CoD, 95-99 percent of the applied phosphorus and 18-31 percent of the total nitrogen. The hypothesis that the Niimi trench was superior to the conventional trench was not demonstrated.
W86-02597

LAND TREATMENT OF SEPTAGE,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
C. J. Clanton, J. L. Anderson, R. E. Machmeier, and M. J. Hansel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233013/AS, Price codes: A02 in paper copy, A01 in microfiche. Minnesota Water Resources Research Center Completion Report, St. Paul, December, 1984. A-045-Minn.

Descriptors: *Septage, Groundwater, Soil, Water, Pollution, Water pollution sources, *Groundwater pollution, *Minnesota.

Even though 225 kg/ha nitrogen applied in septage to a loamy sand soil increased nitrate concentrations in the upper 60 cm of the soil profile, the nitrate concentrations below this point were similar to background concentrations. This indicates that for this soil type, the 225 kg/ha application rate may be considered acceptable. The nitrogen application rate of 1120 kg/ha would exceed the nitrogen storage capabilities of silt loam and clay loam soils because nitrate concentrations increased below the 105-cm depth, where crop nutrient uptake is reduced. Since nitrate concentrations from the 225 kg/ha application rate were less than or similasr to background levels, the acceptable application would be between these two rates. Application of septage did not affect concentrations of fecal streptoccoccus and fecal coliforms in soil water. Septage application resulted in a statistically significant increase in the concentration of soil water potassium, sodium, calcium and magnesium. Application of septage produced an increase in the phosphorus and sodium concentrations in the soil profile at the completion of this project.
W86-02646

ECONOMIC IMPACT OF LIMITING ELECTROPLATING DISCHARGES TO ACHIEVE SPECIFIED WATER QUALITY OBJECTIVES,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5G.
W86-02664

FATE OF SELECTED PRIORITY POLLUTANTS IN REGIONAL WASTEWATER TREATMENT PLANTS IN PUERTO RICO AND THEIR IMPACT OF THE QUALITY OF COASTAL RECEIVING WATERS,
Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering.
R. Roman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-247948/AS, Price codes: A05 in paper copy. Puerto Rico Water Resources Research Institute, Technical completion report, Mayaguez, 1984. 92 p, 42 fig, 27 tab. USGS G866-02. 14-08-0001-G866.

Descriptors: Pollutants, *Wastewater facilities, *Heavy metals, *Fate of pollutants, Municipal wastewater, Primary wastewater treatment, Secondary wastewater, *Puerto Rico, Phenols.

A sampling program at two Regional Muncipal Wastewater Treatment Plants (Ponce and Barceloneta) in Puerto Rico was performed over a period of sixty-six days. Phenol, copper, chromium, lead, zinc, cadmium and total solids were analyzed for the influent, primary effluent, and secondary effuent from forty-eight hour composite samples. Time series, moving average series, removal efficiency analysis, and frequency analysis were performed on the data. The study showed that while some toxic compounds (copper and chromium) primary treatment may be sufficient at the observed influent levels, it is definitely not sufficient treatment for the others (phenol, lead, zinc). Therefore in wastewaters where toxics amenable to primary treatment will coexist with toxics not amenable to primary treatment a secondary treatment plant is mandatory. Even with secondary treatment, it was shown that for some toxics a heavy reliance will have to be made on the dilution effect of the respective mixing zone in order to comply with the Puerto Rico Environmental Quality Board's water quality standards. Frequency of occurrence for the toxics studied was established for the period under consideration which may serve as a baseline for future reference and further studies.
W86-02674

BOD REDUCTION AND BIOMASS PRODUCTION BY AEROBIC DIGESTION OF FERMENTATION BROTHS IN SEA WATER,
Puerto Rico Univ., Mayaguez. Dept. of Chemical Engineering.
M. Findley, and J. Benitez.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-247963/AS, Price codes: A03 in paper copy, A01 in microfiche. Puerto Rico Water Resources Research Institute, Technical Completion Report, Mayaguez, 1984. 36 p, 15 fig, 2 tab, 11 ref. USGS G866-06. 14-08-0001-G866.

Descriptors: *Wastewater treatment, *Aerobic digestion, *Industrial wastes, *Food chains, Fish food, Biomass, Marine bacteria, Fermentation, *Distillery wastes.

An experimental study has been cnducted on the reduction of biological oxygen demand (BOD) and the simultaneous production of marine organisms by means of aerobic digestion of wastes from a rum distillery (mostos or rum slops). The results indicate that such wastes, which are presently being discharged directly into the sea, can be reduced in BOD by a least 50%, by dilution with sea water and aerobic digestion. The resulting digestion products are suitable for growing brine shrimp (Artemia salina). The microorganisms produced are naturally occurring marine organisms, and the brine shrimp are known to be useful as a fish food. Thus this method should enhance the marine food chain while reducing BOD. BOD reduction and biomass growth both increase with pH up to a value of 8, with residence time, and the BOD and mostos concentration up to the level of about 25% mostos in seawater. There are apparently toxic or inhibiting effects at concentrations of 50% and unexplained effects at low residence times. The data are presented such that digestor volume and biomass production can be estimated for a given feed and a required BOD reduction.
W86-02676

ENHANCED REUSE POTENTIAL OF COAL SLURRY TRANSPORT WATER: TOXIC ORGANICS ASSESSMENT AND REMOVAL,
Tennessee Univ., Knoxville. Dept. of Microbiology.
G. S. Sayler, R. A. Minear, M. C. Reid, and J. W. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249035/AS, Price codes: A06 in paper copy, A01 in microfiche. Technical Completion Report, Tennessee Water Resources Research Center Research Report 106, Knoxville, September 1985, 95 p, 24 fig, 20 tab, 80 ref. C-3109-R. 14-08-0001-G-1057(1).

Descriptors: *Coal slurry water, Water pollution sources, *Tennessee, *Slurries, *Water reuse, Waste water reclamation, Humic acids, Chlorination.

This research was conducted to evaluate organic water quality characteristics of raw and treated coal slurry wastewaters that effect potential reuse application of this water resource. The composition and biological treatability of the dissolved organic constituents of coal slurry transport wastewater was examined. In addition, the occurrence of environmental mutagens in the wastewater and potential for formation upon chlorination was determined. The results of the investigation demonstrated that the dissolved organic carbon constituents of the slurry wastewater were of humic material in origin and predominated by moderate to low molecular weight (> 5000MW to < 1000MW) fulvic and non-fulvic acid constituents. Chlorination of the wastewater resulted in the production of significant levels of chloroform primarily from fulvic acid presursor organics. However, non-volatile mutagenic agents were not detected in either raw or chlorinated slurry wastewaters. The results of this investigation demonstrate that renovation of coal slurry wastewater for potential reuse is attainable and that renovated wastewater from the perspective of the organic constituents may not pose adverse ecological or environmental health effects.
W86-02682

MICROBIAL SURVIVAL IN CURED MUNICIPAL COMPOST,
New Hampshire Univ., Durham.
For primary bibliographic entry see Field 5C.
W86-02685

EVALUATION OF HOLLOW FIBER ULTRAFILTRATION AND REVERSE OSMOSIS FOR WASTE WATER REUSE IN THE METAL FINISHING INDUSTRY,
Romicon, Inc., Woburn, MA.
B. R. Breslau, P. R. Lambert, and B. A. Milnes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-126166/AS, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, (1985). 75 p, 13 fig, 29 tab. OWRT C-80268-R. 14-34-0001-8801.

Descriptors: Membranes, *Ultrafiltration, Water reuse, *Waste water treatment, Water pollution treatment, *Membrane processes, Separation techniques, *Metal finishing wastes.

Waste waters generated in the metal finishing industry contain various metal ions that must be removed to facilitate water reuse. Reverse osmosis has previously been shown to be effective in reducing the concentration of selected metal ions from well defined, non-complex metal finishing streams. This program deals with the possibility of improving the performance of the reverse osmosis membrane by pretreating the waste waters with newly developed 'charged' ultrafiltration membranes. To demonstrate technical feasibility on live streams, pilot studies were carried out at a number of production metal finishing facilities. The test program compared the performance of the uncharged, standard XM50 hollow fiber membrane as well as the newly developed charged membranes which were found to exhibit significant divalent ion rejections.
W86-02726

FOULING OF REVERSE OSMOSIS SYSTEMS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 3A.
W86-02728

IDENTIFICATION OF SOIL-WATER CHEMICAL PARAMETERS FOR THE PREDICTION AND TREATMENT OF SUSPENDED SOLIDS IN SURFACE WATER RESERVOIRS OF COAL MINE LANDS,
Kentucky Water Resources Research Inst., Lexington.
V. P. Evangelou, J. H. Grove, and R. I. Barnhisel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132396/AS, Price codes: A03 in paper copy, A01 in microfiche. Research Report No. 160, July 1985. 39 p, 10 fig, 10 tab, 35 ref, append. USGS G-908-02. 14-08-0001-G-908 (FY 84).

Descriptors: *Coal mine wastes, Suspended soils, *Sedimentation, *Sedimentation basins, *Colloids, Clay minerals, Water quality, Spoil disposal.

High concentrations of suspended solids in coal mine sedimentation ponds are a factor in lowering water quality. Colloidal particle settling simulations were carried out in the laboratory to test the influence pH and dissolved solids have on concentration and settling rates of suspended solids. The results of the study reveal that the pH of colloidal coflocculation for the samples tested is between 3.5 and 4.5. Furthermore, liming simulation of acidic sediments, as expected increased colloid dispersion. This increase was dependent on the magnitude of the sodium adsorption ratio (SAR). The greater SAR systems maintained a greater concentration of colloidal suspended particles. However, for the same SAR value when the ionic strength was increased from 4 meg/L to 8 meg/L, sedimentation rate of colloidal particles decreased. The data also show evidence that for the same SAR values when substituting magnesium for calcium, the rate of particle settling increased for one sample but decreased for another. The unexpected behavior is under further investigation.
W86-02739

CONTROLS ON PHOSPHORUS MOBILITY IN THE POTOMAC RIVER, NEAR THE BLUE PLAINS WASTEWATER TREATMENT PLANT,

Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02762

INVESTIGATION OF GROUND-WATER RECHARGE BY INJECTION IN THE PALO ALTO BAYLANDS, CALIFORNIA--HYDRAULIC AND CHEMICAL INTERACTIONS, FINAL REPORT,
Geological Survey, Sacramento, CA. Water Resources Div.
S. N. Hamlin.
Available from: OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4152, 1985. 61 p, 26 fig, 4 tab, 26 ref.

Descriptors: Ion exchange, Aquifer characteristics, Adsorption, Specific capacity, *Clogging, Hydraulic permeability, Water quality, *Reclaimed water, Geochemistry, *Recharge wells, Particle size, Potentiometric level, Saline-freshwater interface, Infiltration, Isotone fractionation, Saline water, *Wastewater renovation, *Groundwater recharge, Chemical reactions, *California, *San Francisco Bay.

The U.S. Geological Survey, in cooperation with the Santa Clara Valley Water District, has completed a study of ground-water recharge by injection in the Palo Alto baylands along San Francisco Bay, California. Selected wells within the Water District's injection-extraction network were monitored to determine hydraulic and chemical interactions affecting well-field operation. The well field was installed to prevent and eliminate saline contamination in the local shallow aquifer system. The primary focus of this study is on factors that affect injection efficiency, specifically well and aquifer clogging. Mixing and break-through curves for major chemical constituents indicate ion exchange, adsorption, and dissolution reactions. Freshwater breakthrough was detected in water-level data, which reflected fluid-density change as well as head buildup. Dissolution of calcium carbonate caused by dilution of saline ground water probably accounts for an apparent increase in specific capacity possibly related to improved aquifer permeability. Adsorption evidently removed trace elements during passage of injected water through the aquifer. In terms of hydraulic and chemical compatibility, the well field is a viable system for groundwater recharge. Aquifer heterogeneity and operational constraints reduce the efficiency of the system. Efficiency may be maximized by careful attention to extraction distribution and quantity and to injection distribution, quantity, and water quality. (USGS)
W86-02837

5E. Ultimate Disposal Of Wastes

MOBILITY OF SLUDGE-BORNE DICHLOROBENZIDINE IN LAND APPLICATION SYSTEMS,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5B.
W86-02466

EVALUATION OF A VEGETATIVE FILTER FOR DAIRY WASTEWATER TREATMENT IN SOUTHERN APPLACHIA,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5D.
W86-02506

SUITABILITY OF MARINE CLAYS AS LINERS FOR HAZARDOUS WASTE DISPOSAL SITES,
Maine Univ. at Orono. Dept. of Civil Engineering.
W. F. Brutsaert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215135/AS, Price codes: A03 in paper copy, A01 in microfiche. Maine Water Resources Institute Completion Report, Orono, November 1984. 36 p, 20 fig, 6 tab, 13 ref. USGS G846-03.

Descriptors: *Clays, *Groundwater pollution, Hazardous materials, *Hydraulic conductivity, *Maine, Hydrocarbons, *Permeability, *Seepage, *Solvent, Waste disposal, Waste storage.

The effects of acetone, toluene and methylenechloride on the marine clays of central Maine were evaluated, to determine the effectiveness of these clays in preventing groundwater contamination. The marine clays of Maine were different from those used elsewhere in similar studies in two ways: (1) mineralogically, and (2) physico-chemically. The clay mineral content is extremely small. Clay size particles consist of ground up rock minerals (mica, chlorite, feldspar, quartz). The cation exchange capacity is very low for clay and the ability to swell and shrink is very small. Measurements of the permeabilities of these clays seem to show no major increases or decreases over time. No major structural changes were observed. An apparent chemical dissolution is occurring as indicated by measurements of Al, Fe, Mn and Si in the effluent. The first impression of the marine clays of the northeast is that they may be more resistant than more mineral clays to physico-chemical alteration when permeated with solvents. Long duration permeameter testing and continued chemical analysis of the effluent would produce a more definitive statement on the long term suitability of these clays as liners.
W86-02516

FUNDAMENTAL CONCEPTS OF AUTODIGESTION OF BIOMASS,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-02536

EVALUATION OF TENNESSEE SITES FOR THE DISPOSAL OF HAZARDOUS WASTES--SOCIAL, ECONOMIC AND TECHNICAL CONSIDERATIONS,
Tennessee Water Resources Research Center, Knoxville.
D. W. Weeter, T. C. Hood, J. A. Roth, F. L. Parker, and K. D. Acker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217743/AS, Price cooes: A07 in paper copy, A01 in microfiche. Research Report No. 101, September 1984. 126 p, 7 fig, 35 tab, 54 ref, 2 append. USGS G870-05.

Descriptors: Hazardous materials, Wastes, *Landfills, Environmental effects, Groundwater pollution, Social impact, Economic aspects, *Tennessee, *Waste disposal sites, *Hazardous wastes.

A model was developed to evaluate the suitability of sites for location of hazardous waste landfills. Unlike previous methodologies, the site evaluation model provides a framework whereby socioeconomic concerns can be incorporated with environmental and institutional factors to determine the overall acceptability of a site. The uniqueness of model lies in its use of multi-disciplinary criteria, and in its numerical site rating which is based on a multiplicative aggregation techniques. The model was applied to three existing waste disposal sites for which the relative security of the site is known. The results were consistent with the known hazard potential of each location. A survey was conducted to gain information on the opinions that citizens have concerning hazardous waste disposal. The survey sample consisted of elected local officials, environmental professionals, and citizen group members. The results show that the use of incentives can have a considerable effect towards gaining support for hazardous waste facilities, and confirm that greater public participation is needed to restore confidence in decisions made concerning hazardous waste disposal by demonstrating that the siting of these facilities is being done in a fair and safe manner. Investigation of the social and economic aspects of hazardous waste disposal should be continued to expand the relatively small data base developed from this survey.
W86-02539

GROUNDWATER MANAGEMENT USING CONTROL ANALYSIS AND MULTIPLE-OBJECTIVE TECHNIQUES,
Nebraska Univ.-Lincoln. Dept. of Mathematics and Statistics.
For primary bibliographic entry see Field 6A.
W86-02599

STUDY OF SOME PUERTO RICAN SOILS AS NATURAL SEALERS OF ATTENUATORS AGAINST GROUNDWATER POLLUTION FROM SANITARY LANDFILL LEACHATES,
Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering.
L. A. del Valle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101359/AS, Price codes: A05 in paper copy, A01 in microfiche. Puerto Rico Water Resources Research Institute Final Technical Report, (Mayaguez), June 1983. 73 p, 51 fig, 2 tab, 61 ref, 2 append. A-065-PR(1). 14-34-0001-1141.

Descriptors: *Leachates, *Sanitary landfills, *Puerto Rico, *Water pollution prevention, *Soil filters, Water quality, Groundwater pollution, Landfills, Heavy metals, Soil types, Leaching, Clays, Land disposal.

Five clayey Puerto Rican soils were packed into columns of PVC pipe and tested for their ability to prevent groundwater pollution from the Mayaguez sanitary landfill. Leachate and groundwater samples collected from column effluents were analyzed for water quality parameters according to the Standard Methods for the Examination of Water and Wastewater. Soil samples were analyzed using methods developed by the American Society for Testing and Materials or by the U.S. Soil Conservation Service. Results indicated that the leachate characteristics varied widely, even for samples taken at the same site. At the Mayaguez sanitary landfill, the concentration of the different components in the leachate appeared greatly diminished in the groundwater under the landfill, except for the Ni content. The Daguey soil showed excellent retention capacity for all measured ions, except Zn which showed a net release. Increased Ni concentrations in the groundwater under the landfill were attributed to the release of heavy metals from scrap in the landfill. In general, the soils used in this study were able to retain many of the leachate components with varying degrees of effectiveness. Passage of the leachates through a soil layer does not guarantee an improvement in the groundwater quality, and may even increase the concentration of some leachate components due to their release by the soil.
W86-02716

FATE OF PHOSPHORUS IN SECONDARILY TREATED WASTEWATER APPLIED TO A FRESHWATER MARSH,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
J. Zoltek, and R. J. Mestan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-126109/AS, Price codes: A07 in paper copy, A01 in microfiche. Florida Water Resources Research Center, Gainesville, Aug 1985. 139 p, 21 tab, 33 fig, 99 ref. OWRT B-050-FLA. 14-34-0001-1214.

Descriptors: *Marshes, Peat, *Phosphorus, Adsorption, Wastewater, *Florida, *Waste disposal, Land disposal, Wetlands.

Marsh soils from 18 locations were gathered in the field and transported to the laboratory for experimentation with synthetic secondarily treated wastewater. Batch studies were performed to determine the phosphorus adsorption as a function of soil parameters such as ash, total phosphorus, iron, aluminum or their extractable counterparts. The highest correlations were consistently between phosphorus uptake and ash, total phosphorus and Tamm extractable phosphorus. When predicting the removal of phosphorus from treated wastewater by adsorption on peat many factors must be taken into account, with the most impor-

tant consideration the type of peat soil being used. Successful phosphorus removal by a wetland system is not solely dependent on any individual component such as soil, vegetation, soil microbes, litter, etc. From the literature and from conclusions drawn in this study the best overall phosphorus removal from treated wastewater by a wetland system appears to occur as a result of treated wastewater contact with the vegetation and soil under moist but not flooded conditions.
W86-02720

GENERAL DESCRIPTION OF THE GEOHYDROLOGY AND BURIAL TRENCHES AT THE LOW-LEVEL RADIOACTIVE WASTE BURIAL FACILITY NEAR BARNWELL, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02862

EFFECTS OF APPLIED WASTEWATER ON GROUND-WATER QUALITY AT FORT CARSON MILITARY RESERVATION NEAR COLORADO SPRINGS, COLORADO,
Geological Survey, Pueblo, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02877

5F. Water Treatment and Quality Alteration

STUDIES OF EFFECTIVENESS OF COMMERCIAL HOME TREATMENT SYSTEMS,
Arkansas Univ., Fayetteville. Dept. of Physical Science.
W. W. Trigg, and R. D. Couser.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211720/AS, Price codes: A02 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project completion Report No. 104, Sept. 1984. 15 p, 5 tab. USGS G-829-09.

Descriptors: *Water pollution sources, Arkansas, *Septic tanks, *Coliforms, Lactose fermenters, Escherichia coli, Enterobacter aerogenes, Chemical contamination, Groundwater quality.

Eleven home water systems were tested representing six different types of filtering systems. Tests were made for Sulfates, Nitrates, Phosphate, Iron, and Escherichia coli and Enterobacter aerogenes before and after passing through a home treatment system. All of the systems removed iron adequately but had little effect on the removal of nitrates, phosphates, sulfates or control of pH. Since none of the ground waters was contaminated by coliforms, nothing was established regarding the effectiveness of bacterial removal by these systems.
W86-02443

RESIDUAL ALUMINUM IN POTABLE WATER,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
W. Sung.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214963/AS, Price codes: A04 in paper copy, A01 in microfiche. Project Completion Report, New Hampshire Water Resources Research Center, Durham, Research Report No. 45, July 1984, 53 p, 8 fig, 12 tab, 37 ref. USGS G856-05.

Descriptors: Alum coagulation, *Water treatment, *New Hampshire, Water quality, Temperature, *Aluminum, Hydrogen ion concentration.

The behavior of aluminum in water treatment facilities using alum coagulation was studied with laboratory jar tests as well as actual plant monitoring. For surface waters with pH > 6, the amount of dissolved aluminum is usually less than 40 ppb. Particulates can also be a sususbstantial source of aluminum in the raw water. The amount of dissolved aluminum in jar tests follow rules of hydrolysis equilibrium when the aluminum dosage is much greater than the amount of organics. The minimum soluble aluminum is about 20 ppb at 25C and occurs at pH about 6.5, and 10 ppb at 5C at pH about 6.9. These pH/solubility curves seem to give a reasonable estimate for the actual water treatment plant data. The amount of particulate aluminum must be a function of alum dosage and water treatment plant conditions. It was determined that under our conditions, 10 to 20% of the particulate aluminum are within a size range of 20 micrometers and less, and that these particulates could be very difficult to remove without the use of coagulant or filtering aids. This study points out the need for distinguishing between soluble and particulate phases and that any drinking water standards should take this as well as total dietary intake into account.
W86-02499

CLARIFICATION OF SURFACE WATERS FOR RECHARGE THROUGH WELLS,
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W86-02567

DEVELOPMENT OF A CHLOROPHYLL MONITORING PROGRAM FOR WATER SUPPLY RESERVOIRS USING IN VIVO FLUORIMETRY,
Connecticut Univ., Storrs. Inst. of Water Resources.
P. H. Rich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-242923/AS, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, September 1984. 68 p, 32 gif, 7 tab, 3 ref. USGS G832-05. 14-08-0001-G-832.

Descriptors: *Eutrophication, *Reservoir Management, *Water treatment, Monitoring, Algicide treatment, *Chlorophyll monitoring, *Florimetry, Pollutant identification.

The In Vivo Flow-Through Fluorimetry (IVF) technique was investigated for its potential value as a chlorophyll monitoring system for use in the drinking water industry. Water column chlorophyll concentrations were monitored in four Connecticut reservoirs by IVF and acetone extractions during summer and fall 1983. At low chlorophyll concentrations (less than 10 ug/L), background fluorescence and temperature effects were significant. At higher chlorophyll concentrations, IVF provided an accurate, fast, and relatively simple estimate of extracted chlorophyll, and documented the vertical distribution of algal chlorophyll in the reservoirs. The onset of algal growth conditions which eventually required algicide treatment was traced for up to three weeks prior to recognition by currently employed procedures. Algicide treatments were vertified by IVF. Alternative management was achieved by changing the depth of the treatment plant intake to avoid algal concentrations located by IVF. Raw intake water monitoring by IVF at the treatment plant correlated well with changes in chlorophyll content in the reservoir.
W86-02661

ENHANCED REUSE POTENTIAL OF COAL SLURRY TRANSPORT WATER: TOXIC ORGANICS ASSESSMENT AND REMOVAL,
Tennessee Univ., Knoxville. Dept. of Microbiology.
For primary bibliographic entry see Field 5D.
W86-02682

PUBLIC WATER SUPPLIES IN PUERTO RICO, 1983,
Geological Survey, San Juan, PR. Water Resources Div.
F. Gomez-Gomez, F. Quinones, M. Lopes, and R. Munoz-Candelario.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-110244/AS, Price codes: A06 in paper copy, A01 in microfiche. Puerto Rico Water Resources Research Institute Technical Completion Report, 1984. 102 p, 16 fig, 75 tab, 3 ref. USGS G866-22. 14-08-0001-G-866.

Descriptors: *Water supply, *Surveys, Well water, Surface waters, *Puerto Rico, Municipal water, Groundwater.

A compilation was made of public water supply facilities serving Puerto Rico's 78 municipios (municipalities). Information was obtained at the Puerto Rico Aqueduct and Sewer Authority which is responsible for development and operation of the island's public water supply system. Data on the facilities include the following: Cartesian coordinates, site name, annual production, and analyses for pH, color turbidity, and major dissolved constituents. Facilities listed include 413 wells and 170 surface-water sites in operation. These provide about 370 million gallons per day of potable water to nearly 850,000 domestic, commercial, and industrial connections.
W86-02719

PILOT STUDIES DEMONSTRATING THE FEASIBILITY OF OZONATION FOR SELECTED MUNICIPAL WATER SUPPLIES,
South Dakota State Univ., Brookings. Dept. of Civil Engineering.
D. A. Rollag.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-126158/AS, Price codes: A06 in paper copy, A01 in microfiche. South Dakota Water Resources Research Institute, Brookings, October 1982. Technical Completion Report, 100 p, 27 tab, 22 fig, 129 ref. OWRT B-058-SDAK. 14-34-0001-9134.

Descriptors: *Water treatment, *Ozonation, *Chlorination, *Costs, Chemical oxygen demand, Organic carbon, Color, Odor, Pilot studies, South Dakota.

On-site ozonation pilot studies were conducted on five municipal water supplies: two sources were groundwater; two rivers; and one a lake. The primary objectives were to determine optimum ozone dosages and contact times for reducing trihalomethanes, chlorine demand, odors, organics, iron and manganese and establish capital and operating costs. At selected contact times and ozone dosages flow, power, temperature, pH, turbidity, ozone, chlorine, iron, manganese, odor, trihalomethanes, total organic carbon (TOC), absorbance, chemical oxygen demand (COD) and color were measured depending on the particular water studied. When ozonated and unozonated raw waters were chlorinated, ozonation reduced trihalomethanes. Usually there was an optimum ozone dosage and at other dosages ozonation increased rather than decreased trihalomethanes. The same was found for odor reductions, although ozonation at all dosages changed typical 'foul, fishy' odors to pleasant ones deemed acceptable to most consumers. Jar tests of raw and ozonated river waters revealed that ozonation improved flocculation in some instances. Ozonation reduced chlorine demand, TOC and COD at certain dosages and increased them at others, but usually was no more effective than coagulation alone. Ozonation oxidized manganese effectively, but the precipitates were finer. Total capital and operating costs ranged from 4.9 to 24.2 cents per 1000 gallons of water treated.
W86-02725

5G. Water Quality Control

OPERATION OF DETENTION FACILITIES FOR URBAN STREAM QUALITY ENHANCEMENT,
Washington Univ., Seattle. Dept. of Civil Engineering.
L. K. Dally, D. P. Lettenmaier, S. J. Burges, and M. M. Benjamin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-204030/AS, Price codes: A13 in paper copy, A01 in micro-

fiche. Water Resources Series Technical Report No. 79, July 1983. 267 p, 41 fig, 15 tab, 53 ref. Bu Rec C-00198-U(0504)(1). 14-34-0001-0504.

Descriptors: *Urban hydrology, *Storm runoff, *Water detention, *Storm water detention, *Water quality enhancement, *Water quality control, Storm water quality, Seattle, *Washington.

The results of a 2-1/2 year sampling program designed to assess the potential use of urban/suburban detention facilities for water quality control as well as runoff volume control are presented. Monitoring was conducted during five storms at each of two field sites which varied significantly in land use: a 31 ha residential subdivision and a 6 ha transit coach operating base, both in the Seattle, Washington area. At each site, inflow and outflow hydrographs were estimated along with pollutant concentrations measured at intervals ranging from 3.75 minutes to one hour. The principal water quality concern at the residential facility, which is a dry pond, was suspended sediment. Resuspension of sediment was a major problem at this site and resulted in negative pollutant removal efficiencies for most storms. Water quality constituents of concern at the second site, which consist of paved transit coach storage and maintenance areas, were oil and grease, cadmium, lead, zinc, phosphorus, suspended sediment and trace organics associated with diesel fuel combustion products (primarily polycyclic aromatic hydrocarbons). The pollutant removal efficiencies at this site were negative for most pollutants for modest storms, while for lesser storms, and for particulate pollutants, removal efficiencies were generally positive. In addition to the esthetic problem and the direct effects of the oil and grease on the receiving water, the results of this study suggested that the pond provides a sink for sediments with concentrated levels of various heavy metals and organic compounds.
W86-02436

REMOVAL OF ARSENIC FROM CONTAMINATED WATER WITH PARTIALLY DEACETYLATED SHELLFISH WASTE,
Alaska Univ., Fairbanks. Inst. of Water Resources.
H. V. Luong, and E. J. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214716/AS, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 184.15, July, 1984. 11 p, 3 fig. USGS G827-03.

Descriptors: *Arsenic, Placer mining, Gold mining, Chitosan, *Water treatment, *Flocculants, Contamination(Water), *Alaska, Groundwater, Streams.

Arsenic is often enriched in placer and lode gold deposits. In Alaska, USA, and Yukon Territory, Canada, there is concern that recently increased activity in gold mining may result in arsenic contamination of pristine streams and groundwaters. Chitosan, a very good cationic flocculant, might be used to remove this arsenic. Shellfish wastes are composed of protein, calcium carbonate and large amounts of chitin. Mucor rouxii spore transformation of shellfish waste could be considered as a nontoxic agent for removing dissolved arsenic (and other heavy metal contaminants) and particulates from placer mine wastes in Alaska. This project attempted to evaluate the arsenic removal capability of partially deacetylated chitin derived from shellfish waste. Chitosan will remove substantial amounts of dissolved arsenate from water, whereas chitin is much less effective. When chitin is transformed by growing cultures of M. rouxii, the modified chitin is no better for the sorption of arsenate than is native chitin. This finding was initially unexpected in that M. rouxii is known to produce an enzyme thought to deacetylate chitin. Native chitin is not the preferred substrate for this enzyme. Thus, while we could not successfully modify chitin with growing cultures of M. rouxii to use as an arsenate sorbant, we have been able to characterize the sorption affinity of chitosan for levels of arsenic commonly found contaminating waters affected by placer mine drainage in Alaska.
W86-02474

IDENTIFICATION OF SOIL-WATER CHEMICAL PARAMETERS FOR THE PREDICTION AND TREATMENT OF SUSPENDED SOLIDS IN SURFACE WATER RESERVOIRS OF COAL MINE LANDS,
Kentucky Water Resources Research Inst., Lexington.
For primary bibliographic entry see Field 5D.
W86-02480

AQUATIC RESOURCES MANAGEMENT OF THE COLORADO RIVER ECOSYSTEM: PROCEEDINGS OF THE 1981 SYMPOSIUM ON THE AQUATIC RESOURCES MANAGEMENT OF THE COLORADO RIVER ECOSYSTEM, NOVEMBER 16-18, 1981, LAS VEGAS, NEVADA,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 6G.
W86-02484

EVALUATION OF COMBINED SEWER OVERFLOW MANAGEMENT STRATEGIES THROUGH PIPE NETWORK COMPUTER SIMULATION,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
R. M. Wright, and M. J. Mulhare.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215028/AS, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, Rhode Island Water Resources Research Center, Kingston, 1984, 48 p, 10 fig, 16 tab, 55 ref. USGS G867-05.

Descriptors: *Combined sewers, *Storm runoff modeling, *Urban runoff, Water pollution control, Mathematical modeling.

Through field investigations CSO hydraulic and water quality characteristics were determined. Data was developed to calibrate and verify the Stormwater Management Model (SWMM). SWMM was used in conjunction with a non-conventional quasi-continuous modeling framework for evaluation of selected CSO abatement strategies. The quasi-continuous framework couples the detail of storm event simulation with historical rainfall record. The modeling approach is based on selected reference storms with nominal frequency of occurrence ranging from 22 events per year to 1 event in 10 years. Baseline conditions were simulated for each reference storm. Pollutant load response curves were developed based on peak rainfall intensity and total rainfall. These curves were used to determine annual pollutant loadings for selected years of rainfall record. The quasi-continuous approach was proven to be a valid alternative to the more costly conventional continuous simulation by directly comparing the annual load predictions of each method. Peak rainfall intensity, in comparison to total rainfall, provided a more accurate validation. The quasi-continous technique was used to simulate proposed abatement strategies. Results indicate for an average year of precipitation the optimum use of interceptor capacity through modification and relocation of slot structures provided pollutant load reductions to local receiving waters approaching the equivalent of secondary treatment levels.
W86-02505

ROLE OF NITRIFICATION IN CONTRIBUTING TO LOW OXYGEN CONDITIONS IN AN URBAN WATERWAY,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 5B.
W86-02508

FURTHER INVESTIGATIONS OF GOLDFISH IN EASTERN WASHINGTON LAKES AND EVALUATION OF ELECTROFISHING AS A TOOL FOR CONDUCTING REMOVAL OPERATIONS,
Eastern Washington Univ., Cheney. Dept. of Biology.
A. T. Scholz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215085/AS, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, Washington Water Resources Research Institute, Pullman, 1984. 17 p, 2 tab, 14 ref. USGS G87-07.

Descriptors: Goldfish, Carassius, *Rotenone, *Fish behavior, *Fish control agents, *Washington, *Electrofishing, *Fish removal.

In eastern Washington, goldfish (Carassius auratus L.) population control through wholelake application of rotenone is not effective and may actually contribute to the roughfish problem. Rehabilitation records of area lakes receiving chronic rotenone treatment reveals that following each application of rotenone, a reduction in species diversity accompanied by a shift in population structure toward roughfish has occurred. Therefore, one long-term effect of chronic rotenone treatment may be selection of resistant fish species that increase the rate of eutrophication and decrease water quality. The purpose of this study is to develop new techniques for effective roughfish control utilizing seasonal behavior patterns.
W86-02511

EFFECTS OF LAND USE PRACTICES ON WATER RESOURCES IN VIRGINIA,
George Mason Univ., Fairfax, VA. Dept. of Biology.
R. C. Jones, and B. H. Holmes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216927/AS, Price codes: A07 in paper copy, A01 in microfiche. Technical Completion Report, Virginia Water Resources Research Institute, Blacksburg, April 1985. 130 p, 5 tab, 259 ref, append. USGS G874-02.

Descriptors: *Water pollution sources, *Land use, *Water management, Agricultural runoff, Agricultural hydrology, Forest hydrology, Forest management, Urban hydrology, Urban runoff, *Virginia.

This study reviews the relationship between land use and water resources in Virginia. It examines three major land uses in the state--agricultural, urban, and forestry activities. For each land use, the relevant literature and state management programs are reviewed. In addition, the report outlines research needs in each area. Agricultural activities affect the receiving waters of Virginia through increased loads of sediment, nutrients, pesticides, and pathogens. In general, pollutant loads are greatest from more intensive agricultural activities. Sediments and particulate nutrient losses can be controlled by soil conservation BMPs. However, dissolved nutrient losses may require other strategies. Urban land uses have the potential to increase sediment, nutrient, and heavy metals loads. Forestry practices may damage receiving waters through sediment loadings and alteration in stream habitat due to removal of riparian vegetation. Recommended future research includes documentation and refinement of the effectiveness of existing BMPs, investigation of the effectiveness of urban sediment BMP enforcement, determination of the significance of pathogen indicator organisms in urban and agricultural runoff, evaluation of the long-term cost of BMP structures, demonstration of agricultural and forestry BMPs, and exploration of the pollutant delivery problem in watersheds.
W86-02523

STUDY AND PREDICTION OF BACTERIAL AND VIRAL CONTAMINATION OF GROUNDWATER FROM LANDFILLS AND SEPTIC TANK SYSTEMS,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-02535

EVALUATION OF TENNESSEE SITES FOR THE DISPOSAL OF HAZARDOUS WASTES--SOCIAL, ECONOMIC AND TECHNICAL CONSIDERATIONS,

Tennessee Water Resources Research Center, Knoxville.
For primary bibliographic entry see Field 5E.
W86-02539

CONCURRENT REMOVAL OF TOXIC HEAVY METALS AND ORGANIC SUBSTANCES BY ACTIVATED CARBON PROCESS FROM CONTAMINATED GROUNDWATER,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-02544

OPTIMUM TREATMENT FOR COAL PILE RUNOFF IN LOUISIANA,
Louisiana Water Resources Research Inst., Baton Rouge.
For primary bibliographic entry see Field 5D.
W86-02549

EVALUATION OF NON-POINT POLLUTION CONTROL PRACTICES AND COPPER TREATMENTS ON CONTROL OF NUISANCE FILAMENTOUS ALGAE,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
C. A. Lembi, D. F. Spencer, and S. W. O'Neal.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225886/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 170, December 1984, 54 p, 11 fig, 5 tab, 10 ref, 2 append. USGS G841-04.

Descriptors: *Non-point pollution sources, *Nuisance algae, *Water pollution control, Algal control, Algicides, Surrey Lake, *Indiana.

Runoff studies were initiated in May 1984 on an erodible soil with slopes ranging from 4.6 to 13.8%. 100 ft2 plots were divided into two tillage treatments: 1) no-till and 2) conventional plow system. Within each tillage treatment, three nitrogen application techniques were used: 1) surface application of ammonium nitrate pellets (33.5% N), 2) injected anhydrous ammonia, and 3) injected anhydrous ammonia stabilized with the nitrification inhibitor nitrapyrin. A fourth set of plots was left unfertilized. All application rates were at 200 lbs nitrogen per acre. Two light rainfalls of 1.4 inch and 0.2 inch were followed a month later by a heavier rainfall of 2.5 inch. The only significant effect of nitrogen application technique on nitrogen runoff was a greater NH3-N runoff from surface applications (in both conventional and no-till plots) than other application methods at the 2.5 inch rainfall date. No differences could be detected in NH3-N or NO3-N runoff from untreated control, injected nitroge, or stabilized injected nitrogen plots. Use of the runoff data in conjunction with a model of the growth of the nuisance filamentous alga Pithophora in Surrey Lake, Indiana suggests that conversion of the agricultural land in the watershed from a conventional till, anhydrous ammonia injected management system to a no-till system with either anhydrous ammonia injected alone or injected with nitrapyrin should lead to a noticeable reduction (approximately 40%) in Pithophora growth. The analysis further suggests that use of conventional tillage in combination with injected ammonia with nitrapyrin or surface applications of ammonium nitrate would lead to increased growth of Pithophora.
W86-02564

PHYTOPLANKTON CONTROL AND WATER QUALITY IMPROVEMENT THROUGH MANIPULATION OF ANIMAL COMMUNITIES,
Nebraska Univ.-Lincoln. Dept. of Forestry, Fisheries and Wildlife.
For primary bibliographic entry see Field 5C.
W86-02583

SEDIMENT AND PESTICIDE/HERBICIDE TRANSPORT RELATIONSHIPS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 5B.
W86-02642

ECONOMIC IMPACT OF LIMITING ELECTROPLATING DISCHARGES TO ACHIEVE SPECIFIED WATER QUALITY OBJECTIVES,
Connecticut Univ., Storrs. Inst. of Water Resources.
R. L. Leonard, and G. E. Hoag.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-242956/AS, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, September 1984. 35 p, 15 tab, 31 ref. USGS G832-03. 14-08-0001-G-832.

Descriptors: *Electroplating economics, *Electroplating waste discharges, Electroplating, Industrial wastewater, *Wastewater treatment, *Economic impact, *Connecticut, *Pretreatment requirements, *Copper, Naugatuck River, *Water quality standards.

Federal regulations established on July 15, 1983, substantially reduced the economic significance of interstate differences in technology based effluent limitations for direct discharges of electroplating wastewater. However, Federal regulations regarding pretreatment of existing discharges to municipal sewage systems are extremely lax compared to either Federal direct discharge standards or Connecticut pretreatment requirements. Of six regionally competitive states only Connecticut has a general set of pretreatment standards for electroplating wastewater. Municipal pretreatment standards in neighboring states vary widely and are generally lax compared to Connecticut standards. Research regarding water quality management was focused on copper in the upper third of the Naugatuck River. The copper load and concentration were estimated for each point of discharge with existing and advanced treatment of industrial wastewater. A 90 percent reduction in existing industrial discharges would make only limited progress toward achievement of a tentative, site-specific water quality standard of 0.0102 mg/1. Approximately 68 percent of the copper being discharged to the River is from domestic sewage. Estimated costs per unit of copper removed by advanced treatment vary widely among discharges.
W86-02664

RIPARIAN SHRUBBY VEGETATION PROTECTION AGAINST HERBIVORE BROWSING,
Oregon State Univ., Corvallis. Dept. of Rangeland Resources.
For primary bibliographic entry see Field 4D.
W86-02670

FINANCING WATER PROJECTS IN NORTH CAROLINA: THE STATE ROLE,
North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 6C.
W86-02709

STUDY OF SOME PUERTO RICAN SOILS AS NATURAL SEALERS OF ATTENUATORS AGAINST GROUNDWATER POLLUTION FROM SANITARY LANDFILL LEACHATES,
Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W86-02716

PRELIMINARY EVALUATION OF HYDROLOGIC PROPERTIES OF CORES OF UNSATURATED TUFF, TEST WELL USW H-1, YUCCA MOUNTAIN, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02792

INVESTIGATION OF GROUND-WATER RECHARGE BY INJECTION IN THE PALO ALTO BAYLANDS, CALIFORNIA--HYDRAULIC AND CHEMICAL INTERACTIONS, FINAL REPORT,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5D.
W86-02837

HYDROGEOLOGIC SETTING EAST OF LOW-LEVEL RADIOACTIVE-WASTE DISPOSAL SITE NEAR SHEFFIELD, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02871

GEOHYDROLOGIC AND DRILL-HOLE DATA FOR TEST WELL USW H-4, YUCCA MOUNTAIN, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02895

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

COST-EFFECTIVE DESIGN AND OPERATION OF URBAN STORMWATER CONTROL SYSTEMS: DECISION-SUPPORT SOFTWARE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-02427

VOLUNTARY BASINWIDE WATER MANAGEMENT: SOUTH PLATTE RIVER BASIN, COLORADO,
Colorado Water Resources Research Inst., Fort Collins.
N. S. Grigg, H. P. Caulfield, N. A. Evans, J. E. Flack, and D. W. Hendricks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214799/AS, Price codes: A08 in paper copy, A01 in microfiche. Project Completion Report, September, 1984. 160 p, 28 fig, 174 ref, 2 append. USGS G831-02.

Descriptors: *Colorado, South Platte River basin, *Water management, *Resources management, Groundwater management, *Public policy, *Water supply development, Computer models.

Demands for water in the South Platte River Basin are the most intense in Colorado and the result is increasing conflict over water use. The resulting litigation places financial burdens on water right owners and stresses one capability of the state administrative agencies to respond with water management decisions. A voluntary association of water right owners is proposed as a mechanism to increase the options of water users and reduce conflict over water use. The initiative for organizing it would be by the water right owners themselves. The South Platte Research Team believes that such an association could help achieve voluntary integrated basinwide water management. The associaton of water right owners would need information on management and exchange possibilities and the resulting impacts. Computer-based models can provide the information. Two hydrologic and decision models which are available at Colorado State University for this purpose are described. Other hydrologic models and economic models can also be utilized by the association. This report points out possible actions. It must be followed by discussions and debate, by demonstrations of what the models can accomplish, by organizational activity, and perhaps by new legislation. The research team plans to conduct workshops to discuss the next steps.
W86-02482

OPTIMAL EXPANSION AND OPERATION UNDER UNCERTAINTY OF A WATER SUPPLY SYSTEM WITH MULTIPLE WATER SYSTEMS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
C. A. Shoemaker, and J. M. Kersnar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216992/AS, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, Sept 1984. 8 p, 5 fig, 7 ref. USGS G859-06.

Descriptors: *Linear programming, *Municipal water, *Risks, *Water shortage, *Water supply systems, Contamination, Drought, Expansion, Frequency analysis, Groundwater management, Mechanical Failure, Operating policies, Reservoir operation, Systems analysis.

A scenario-consequence approach is used to assess the risk of water shortages occurring in water supply systems with single or multiple types of water supply sources. Total deficits-scenario duration relationships are found using a linear program model of the water supply systems for different scenarios. Information about the probability of occurrence of these scenarios can be used to determine the probability of occurrence of water shortages of certain magnitudes. Knowledge of the magnitude, duration and frequency of water shortages for different alternative expansions or operating policies of a water supply system can be used to determine the optimal alternative in terms of reducing the risk of water shortages. The methodology developed was demonstrated using the water supply system of the Elmira-Horseheads-Big Flats area of New York.
W86-02530

DEVELOPMENT OF A SIMPLE, RELIABLE, INDEX OF DROUGHT WARNING AND DROUGHT EMERGENCY TO AID MUNICIPAL WATER SUPPLY MANAGEMENT,
Delaware Univ., Newark. Dept. of Geography.
For primary bibliographic entry see Field 2A.
W86-02545

ECONOMIC APPROACH TO THE ESTIMATION OF A DYNAMIC PRODUCTION FUNCTION FOR AN IRRIGATED CROP,
California Univ., Davis. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W86-02569

DESIGN OF A DROUGHT MANAGEMENT EXERCISE: SIMULATION GAMING APPLIED TO THE INDIANAPOLIS WATER SUPPLY SYSTEM,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. T. Diamond, J. R. Wright, M. H. Houck, and D. Randall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-226330/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 166, August 1984. 51 p, 14 fig, 3 tab, 32 ref. USGS G841-23.

Descriptors: Technology transfer, *Drought, Management planning, Simulation analysis, Indianapolis, *Indiana, *Drought management, Water supply, Decision making.

The potential use of simulation gaming to enhance the effectiveness of drought management planning in Indianapolis is described. First, the probability of experiencing a severe drought in Indianapolis is examined using historical streamflow data. The effects of such a drought on the municipal water supply system are then analyzed using a recently developed simulation model of the Indianapolis water system. Consideration is given to the water resource decision making problems which might arise under drought conditions, along with a discussion of the benefits of employing simulation gaming in the analysis of these problems. A basic outline for the design of a drought management simulation exercise is provided. References to relevant literature are included.
W86-02580

GROUNDWATER MANAGEMENT USING CONTROL ANALYSIS AND MULTIPLE-OBJECTIVE TECHNIQUES,
Nebraska Univ.-Lincoln. Dept. of Mathematics and Statistics.
J. P. Dauer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227346/AS, Price codes: A02 in paper copy, A01 in microfiche. Technical Completion Report, Nebraska Water Resources Center, Lincoln (1984). 19 p, 44 ref. USGS G854-02. 14-08-0001-G854.

Descriptors: *Nebraska, *Mathematical models, Water resources management, *Optimization, *Linear programming, Control systems, Groundwater models, Multiple objective control system.

The overall objective of this project was to develop mathematical optimization techniques, theory and models which are applicable in the management of groundwater systems. The motivation for this research was to improve the analytical techniques that can be used in solving certain groundwater problems. A primary objective was to analyze mathematical systems using a control theoretic approach and multiple-objective techniques. Specific major accomplishments were as follows: (1) A multiple objective waste disposal model was developed and analyzed. The model is a modification of the single objective waste disposal model of Alley, Aguado and Remson. The solution structure was obtained using the method of constraints so that dual variables (shadow prices) are available with the solutions. This model proved to be significantly better for analyzing the system than previous models. (2) An analysis of the objective space for a multiple objective linear program was completed with the development of an algorithm for determining the nondominated objective values that are extreme points. Since not all extreme points (nor edges) of the constraint space map to extreme points (edges) of objective space, this algorithm analyzes a simpler structure than that analyzed by algorithms based on the extreme points of the constraint space. This technique thus proves to be very powerful in analyzing large, multiobjective systems.
W86-02599

IMPROVING EFFECTIVENESS IN PLANNING AND EQUITY FINANCING OF STATE WATER RESOURCES MANAGEMENT,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 6E.
W86-02643

APPLIED MODELS FOR IMPROVED URBAN WATER MANAGEMENT,
Delaware Univ., Newark. Coll. of Urban Affairs and Public Policy.
F. Tannian, and Y. D. Wang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101243/AS, Price codes: A05 in paper copy, A01 in microfiche. Delaware Water Resources Center Technical Completion Report, Newark, July 1983. 75 p, 14 fig, 7 tab, 10 ref, 1 append. A-037-DEL(1). 14-34-0001-6008.

Descriptors: *Water demand, *Delaware, *Water supply development, *Model studies, *Metropolitan water management, Decision making, Water rates, Water management, Future planning, Municipal water, Models, Mathematical models, Economic aspects, Prices, Income.

Aspects of water demand and supply conditions for two municipal water systems in Delaware, those of Wilmington and Neward, were investigated. These two water systems are the major public water suppliers in Delaware. All residential and commercial customers in the city limits of both places depend on these systems for water. In addition, large areas outside the city limits are also served by these two systems. Water management practices were evaluated by a structure of analysis based on microeconomics. This theory suggests that user behavior for any resource, not merely water, can be affected by incomes and by the price of the resource. Generally income variation is positively related with water demand and use, while price variation is inversely related to water use. Several sub-models were developed to state certain expected relations between water and several other variables such as cost, volume production, and water demand estimates. Once the ideas of the model frameworks were adapted to the form of equations, variables in the equations could be measured. Statistical analyses were used to estimate, for example, how price, income or perceptions of water quality are related to water use, water production or satisfaction with urban water systems. Implications for practical urban water management decisions and evaluation of the models and their outcomes are discussed.
W86-02705

POLICY ANALYSIS OF RESERVOIR OPERATION, VOLUME I: EXECUTIVE SUMMARY; VOLUME II: COMPONENT STUDIES,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
J. Cohon, C. ReVelle, J. Wright, J. Smith, and R. Steiner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-127289/AS, Price codes: A08 in paper copy, A01 in microfiche. Final Report, July 1982. 139 p, 7 fig, 6 tab, 75 ref. OWRT C-90308-C. 14-34-0001-0407.

Descriptors: *Water consumption, *Rainfall, *Drought, *Mathematical studies, *Model studies, Times series analysis, *District of Columbia, *Potomac River Basin, *Municipal water consumption, *Point process models, Poisson process, Cox process, Clustered point processes.

The effects on municipal water consumption of weather variables and of the change from a uniform rate structure to one with multiple blocks were investigated. The study consisted of building a model to predict water consumption based on price and weather variables and determining whether a new rate structure led to significant conservation. A least squares linear regression model was developed using aggregated water use per connection as the dependent variable and price of water, personal per capital income, precipitation and maximum daily temperature as explanatory variables. The criteria for analysis of the models consisted of examining the adjusted coefficient of determination and the standard error of estimate. Also the error terms were analyzed, and hypothesis tested and confidence intervals were specified for the estimated parameters. The models using daily data provided significant parameter estimates of the weather variables, that is, weather influences showed up clearly. The coefficient of the price variable was not significant. A set of point process models was derived for summer season rainfall in the Potomac River basin for application to drought management problems. The models were developed for application to streamflow prediction problems during drought periods and as a means to infer information on the processes that create and sustain droughts in the Potomac River basin. The modeling is termed an RCM process (for Renewal Cox process with Markovian intensity). Three topics pertaining to clustering in point process models of rainfall are discussed. First a frame work for interpreting clustering based on properties of the Poisson processes is presented. Clustering is viewed in terms of departures from the properties of Poisson (homogeneous) processes. The second topic, Cox processes (Poisson processes with randomly varying rates of occurrence) are presented. Thirdly, the overlaps among three classes of point processes are discussed; these three classes of point processes have commonly been used to model 'clustered' point process data: renewal processes, Poisson cluster processes, and Cox processes. The results that are presented have particular importance for model selection and interpretation.
W86-02730

6B. Evaluation Process

WATER MANAGEMENT SIMULATOR PRESENTATIONS,
Arkansas Univ., Fayetteville.
E. Mack.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211803, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, Pub No 112, 7 p, September 1984. G-829-22.

Descriptors: *Water management, Simulation analysis, Information exchange, *Arkansas, *Public participation, *Public education.

One of the larger stumbling blocks to comprehensive water management is the lack of public understanding of the multitude of variables that operate at the same time within the hydrologic cycle. With more public understanding, there is greater public support for various water projects. Dr. John R. Amend, Montana State University, developed a water management simulator which could handle a large number of variables simultaneously of natural surface and groundwater flow plus a number of water-use variables on an accelerated time sequence. By using several remote control devices, participants can 'control' their water use but have no control over other participants competing for the same water molecule. The purpose of this information transfer project was to demonstrate the use of the water management simulator and to begin to develop experienced teams of people from government agencies and academia to explain its operation to local professional and civic groups. The interest level is very high for the team members to learn about the operation of the water management simulator. The simulator demonstrations have been well received by various audiences.
W86-02451

IDENTIFICATION AND PRIORITIZATION OF THE WATER RESOURCES PROBLEMS AND RESEARCH NEEDS IN THE DISTRICT OF COLUMBIA,
District of Columbia Univ., Washington. Water Resources Research Center.
M. H. Watt, and S. A. Besse.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225969/AS, Price codes: A05 in paper copy, A01 in microfiche. Report No. 61, Sept. 1984. 81 p, 4 tab, 5 append. USGS G834-23.

Descriptors: *Washington(DC), *Urban hydrology, Priorities, *Problem identification, *Research needs, Objectives, Survey, Questionnaire, Statistical methods, Water quality, Non-point source pollution.

A survey was conducted to identify and prioritize the water resources problems and research needs in the District of Columbia. The survey was directed to individuals knowledgeable of the District's water resources. Using uni-objective ranking techniques, the three problem areas highlighted as most important were: (1) the water quality of the Anacostia River, (2) combined sewer overflows, and (3) degradation of surface waters from non-point source pollution. In the past the water quality and associated pollution problems of the Potomac River and Rock Creek Park have received much more attention. It is now understandable that the Anacostia River should be given more attention. It is well known that the Anacostia River is severly impacted by a concert of water pollution problems and that it is being considered for planned waterfront development. It has also been established that both non-point source pollution and combined sewer overflows are in one way or the other impacting the Anacostia and its tributaries and contributing to the overall poor health of its waters.
W86-02572

DERIVATION OF UNIT-DAY-VALUES FOR RECREATION BENEFIT VALUATION IN WATER RESOURCE PLANNING, BASED ON A COMPREHENSIVE THEORETICAL FRAMEWORK,
George Washington Univ., Washington, DC. Dept. of Engineering Administration.
R. C. Waters, and R. Valderrama.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225977/AS, Price codes: A03 in paper copy, A01 in microfiche. D.C. Water Resources Research Center, Washington, District of Columbia, Report N No 58, September 1984. 30 p, 40 ref. USGS G834-06.

Descriptors: *Recreational benefits, *Willingness-to-pay, *Contingent valuation, *Unit-day-values, *Travel cost method, Federal water resource planning, Valuation board, Economics, Planning.

The study concerns the provision of water-based recreation from federal investments. Access to water-based recreation opportunities are provided without charge. Since the user does not pay, the issue becomes: how much recreation access should be provided by the federal government for private consumption. The agencies have assumed that as long as benefits exceed costs then additional increments of recreation opportunities should be provided to the extent that Congress authorizes and appropriates the funds. The federal agencies have attempted to develop benefit valuation procedures consistent with the theoretical notion, which is based on welfare economics, of willingness-to-pay. These procedures are the travel cost method and the contingent valuation or survey method. Furthermore, as an interim measure, they have developed the unit-day-value method (UDVM). UDVM consists of an administratively determined value. This study evaluates the arguments associated with the various methods. Also, it weights the arguments and suggests a course for future action. The evidence suggests that federally provided water-based recreation is in reality a political process, furthermore the present recommended procedures even if correctly implemented do not lead to Parato optimal economic efficiency. They are faulty from both a theoretical and an operational basis. The UDVM is a more realistic approach to a complex problem which goes beyond economic efficiency. A valuation board of the Congress should be established to set appropriate values or guidelines for water-based recreation. Until then, leaving the valuation issue to each agency seems appropriately expedient.
W86-02573

UNCERTAINTY IN MODERN IMPOUNDMENT MODELS: EFFECTS AND METHODS OF ANALYSIS,
Nevada Univ. System, Las Vegas. Water Resources Center.
For primary bibliographic entry see Field 5B.
W86-02623

DEVELOPMENT AND MANAGEMENT OF WATER FACILITIES FOR SMALL COMMUNITIES: PROCEEDINGS OF A CONFERENCE,
Virginia Water Resources Research Center, Blacksburg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-242881/AS, Price codes: A06 in paper copy, A01 in microfiche. September 1981. 95 p. Edited by W. R. Kerns. OWRT C-00176-T(No. 0518)(4).

Descriptors: *Virginia, *Water resources development, *Water supply development, *Community development, *Resources development, Economic aspects, Water management, Resources management, Water demand, Water law.

The objective of this conference was to provide a forum for exchange of information and for discussion of issues and problems related to providing water for small communities and rural areas. Participants included owners and managers of water systems, elected and appointed officials, state and federal management personnel, and members of the scientific community. Presentations and discussion focused on the current state of water facilities, availability and protection of water supplies, organization of delivery systems, regionalization of systems, available resources for planning and development, rural water associations and management and financial analysis.
W86-02657

OPPORTUNITY COSTS: IRRIGATION VS. HYDROPOWER,
Oregon State Univ., Corvallis. Dept. of Agricultural and Resource Economics.
For primary bibliographic entry see Field 6C.
W86-02679

APPLIED MODELS FOR IMPROVED URBAN WATER MANAGEMENT,
Delaware Univ., Newark. Coll. of Urban Affairs and Public Policy.
For primary bibliographic entry see Field 6A.
W86-02705

RED RIVER GORGE RESIDENTS: A CULTURAL AND HISTORICAL PERSPECTIVE,
Kentucky Water Resources Research Inst., Lexington.
P. L. Brinegar, B. R. DeWalt, and E. C. Scott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101318/AS, Price codes: A05 in paper copy, A01 in microfiche. Research Report No 156, June 1985. 74 p, 4 fig, 6 tab, 81 ref. A-079-KY. 14-34-0001-1119.

Descriptors: *Kentucky, *Recreation facilities, Recreation demand, Wild rivers, Tourism, Management planning, Social aspects, River recreation management, Landownership, National forests.

This study investigates the relationship between the remaining residents of Appalachian Eastern Kentucky's Red River Gorge area and their environment with special emphasis on the historical and current social factors that play a role in their refusal to vacate the area. For two decades, these people have faced the possibility of losing their land and homes to area development projects while they have simultaneously become aware of what it can mean to be labeled 'Appalachian'. Currently, they are contending with the implications of a management plan proposed by the U.S. Forest Service. Cross-cultural research on areas developed as recreational arenas indicates that the residents as a whole stand only to lose in such situations. The optimum solution from the perspective of the people along the Red River is to be left alone, but this is not going to happen as the popularity of the Gorge has steadily grown over the past years and as the Forest Service has greatly increased its holdings. Appropriate planning to reduce the losses of the locals who view their land as irreplaceable is suggested as a primary consideration in this area and in others where recreational development is planned.
W86-02712

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

EFFECTS OF REDUCED STREAM DISCHARGE ON FISH AND AQUATIC MACROINVERTEBRATE POPULATIONS PHASE II,
Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.
R. G. White, A. E. Bingham, J. H. Milligan, M. A. Brusven, and C. A. Corraino.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214922/AS, Price codes: A10 in paper copy, A01 in microfiche. Technical Completion Report, Idaho Water Resources Research Institute, Moscow, March, 1985. 181 p, 64 fig, 28 tab, 77 ref. B-053-IDA(1). 14-34-0001-0216.

Descriptors: *Fish behavior, Fish populations, *Flow control, Invertebrates, *Idaho trout, Discharge fluctuations.

Two man-made test channels were used to investigate the effect of reduction of stream discharge on juvenile rainbow-steelhead trout and invertebrate

populations. Wild juvenile rainbow-steelhead trout responded to seasonal 95% reductions in discharge by emigrating from the test channel. An intermediate (50%) reduction in discharge during 1980 tests resulted in little change in number or biomass. Most emigration occurred during the first night following the 95% flow reduction and was predominantly upstream. Since aquatic insects drifted catastrophically during the 24 hours following flow reduction, habitat changes, rather than food limitation, are indicated as the causative factor. A poor relationship was observed between facing velocity and the corresponding 0.6 depth velocity utilized in several predictive models. The 95% flow reduction resulted in no decrease in benthic insect density except during spring. However, numbers of Baetis tricaudatus were reduced in all experiments. Species diversity and insect functional groups showed little response to reduced flows. Moderate numbers of insects were stranded in the spring; most insects were stranded in the fall. Reduced flows had little effect on the hyporheic insect community.
W86-02495

FINANCING URBAN WATER: EFFICIENCY AND EQUITY OF MAJOR ALTERNATIVES,
Arizona Univ., Tucson. Dept. of Economics.
R. B. Billings, E. F. McElwain, and W. M. Day.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227205/AS, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, Arizona Water Resources Research Center, Tucson, Sept 1984, 92 p, 1 fig, 24 tab, 96 ref. USGS G828-03.

Descriptors: *Arizona, *Water costs, *Water policy, Finance, *Cost repayment, Taxes, *Water pricing, Administration, Water management, Budgeting, Water demand, Prices, Forecasting, Water conservation, Economic efficiency.

Urban water utility costs will increase greatly in the future to expand capacity and repair deterioration. Alternative methods of financing increased costs are analyzed to trace effects on the economic efficiency of water use and on the equity of the distribution of costs. Effects on water demand and utility revenues are reviewed. The analytical framework is applied to a case study of how Tucson, Arizona and the Central Arizona Water Conservancy District (CAWCD) might finance their shares of the cost of Central Arizona Project (CAP) water. Numerical estimates of required extra sales, property and pump tax rates, and water user fee levels are estimated for a range of possible costs. The CAWCD could finance its CAP capital payments by the currently anticipated user fees and property tax, an additional property tax rate of 17 cents per $100 AV or a pump tax between $12 and $20 per acre foot. Tucson could finance its CAP-related costs with an extra retail sales tax rate of 0.1% to 0.2%, an additional 18 cents to 66 cents property tax rate, or a 12% to 21% increase in the real price of water, allowing for the price-induced drop in use by 2000.
W86-02585

OPPORTUNITY COSTS: IRRIGATION VS. HYDROPOWER,
Oregon State Univ., Corvallis. Dept. of Agricultural and Resource Economics.
B. A. McCarl, and M. Ross.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-247997/AS, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Publication WRRI-96, Corvallis, September 1984. 39 p, 3 fig, 7 tab, 20 ref. USGS G864-06. 14-08-0001-G-864.

Descriptors: *Opportunity costs, *Welfare costs, *Economic evaluation, *Hydroelectric power, Irrigation, *Irrigation requirements, *Water allocation, *Water management, Water use, Alternative water use, Competing use, Value, Costs, Economic aspects, *Cost analysis, *Electric power costs, Social costs, Economic models, *Columbia River Basin.

Costs imposed on participants in the electricity market arising from irrigation diversions from the Columbia River are analyzed. Six hypotheses are examined: a) that electricity consumers' welfare is not affected by irrigation diversions, b) that hydropower loss estimates derived using time- and location-specific data do not differ from those derived using average data, c) that water year chosen does not affect welfare losses, d) that demand elasticity does not affect welfare losses, e) that farmer repayments do not affect welfare losses, and f) that interruption of water in critical low-flow does not affect welfare losses. Electricity consumers are found to lose welfare when diversions are increased. Considering a potential diversion in Central Washington, the annual loss to electricity consumers is in excess of $100 per acre developed. When the government delivers water to farmers' fields, this loss exceeds $200 per acre. In addition, the welfare loss estimates are found to be sensitive to the amount of pumping costs diverters pay and to the potential interruption of diversions. The results under the diversion interruption simulation show potential for reducing the tradeoffs between irrigation development and hydroelectric power generation.
W86-02679

FINANCING WATER PROJECTS IN NORTH CAROLINA: THE STATE ROLE,
North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning.
T. Snyder, D. Whittington, and D. Hillstrom.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101284/AS, Price codes: A04 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Completion Report No 220, August, 1984. 62 p, 4 fig, 12 tab, 50 ref.

Descriptors: *Financing, *Water treatment facilities, Wastewater facilities, *User charges, *North Carolina.

Over the past decades, federal and state grants have been a major source of capital to build public-owned water and wastewater facilities in North Carolina. However, recent changes in policies at both levels have shifted the burden to local governments, some of whom may not have the financial capacity to expand and replace necessary facilities. This report reviews past patterns of grants for these facilities in North Carolina and their impact on recipient communities. Alternative financing options for state and local governments are examined, including a review of approaches either taken or being considered in other states. Criteria for evaluating alternatives as they may be adapted to the needs of North Carolina are also considered. The study examined the advantages and disadvantages of various policy options available to the State of North Carolina for assisting with the financing of water services. Five water-financing alternatives are evaluated: state grant and aid programs; state subsidization of loans and water bonds; user fees, special assessments, and local taxes; revision of state bonding authority; and private or public-private ownership of water facilities. From their examination of the current water-financing situation in North Carolina, the authors conclude that there is no magic, easy, or 'innovative' solution that will avoid the reality that water services are now generally underpriced in this state, and consumers will ultimately have to pay higher prices for water and sewer services or higher taxes to ensure high-quality water services.
W86-02709

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02885

6D. Water Demand

IMPACT ASSESSMENT OF COAL SLURRY PIPELINES ON WATER RESOURCES UTILIZATION AND ALLOCATION,
Kentucky Water Resources Research Inst., Lexington.
M. N. Saquib, M. L. Kavvas, D. T. Kao, and L. Ormsbee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214609/AS, Price codes: A06 in paper copy, A01 in microfiche. Research Report No 153, August 1984. 100 p, 27 fig, 4 tab, 21 ref, 2 append. USGS G-844-06.

Descriptors: Water demand, Slurry pipelines, Pipelines, Slurries, Water consumption, *Kentucky, *Coal mining.

Pike county, the largest coal producing and exporting county from the state of Kentucky was studied to assess the impact of a possible coal slurry pipeline project on the water resources allocation and utilization in the region. Potential coal slurry pipelines from the region were identified and water requirement for operating several hypothetical pipelines were computed by using a recently developed computer program. Climatological data for the country were collected and analyzed for a 29-year period of record with a view to determining the monthly net consumptive use in the region. Available groundwater data for the region was also collected in an effort to assess the groundwater situation of the region. Present urban demand was quantified and an estimate of urban demand in 2010 A.D. was made by using the population projections. Streamflow data from three flow gaging stations encompassing almost the entire drainage basin of the streams in Pike county were collected. On the assumption that the water required for coal slurry pipelines would be withdrawn from a location near Pikeville, only the streamflow records from the USGS gaging station No. 03209500 on the Levisa Fork at Pikeville were analyzed to determine the risk in meeting the total demand (urban demand and minimum baseflow requirement plus combined demand for operating all seven hypothetical coal slurry pipelines) in any month of the year. The allowable demand at 5% risk defined as sustainable withdrawal was also computed on a monthly basis.
W86-02464

HOUSEHOLD CONSERVATION DURING WATER EMERGENCIES, TWO CASE STUDIES,
New Hampshire Univ., Durham. Dept. of Sociology.
L. Hamilton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214930/AS, Price codes: A06 in paper copy, A01 in microfiche. Project Completion Report, New Hampshire Water Resources Research Institute, Durham, Research Report No. 44, July 1984. 100 p, 19 fig, 13 tab, 11 ref. USGS G856-02.

Descriptors: *Water conservation, *Public opinion, Attitudes, Behavoir, *Water contamination, *New Hampshire, *Massachusetts, Water quality.

This report describes public reactions to water conservation programs in two New England communities (Milford, New Hampshire and Acton, Massachusetts) which recently lost water supplies due to chemical contamination. In both towns, data were collected from mailed questionnaires sent to random samples of households on the town water systems. These survey data were analyzed to shed light on patterns in the adoption of water-saving behavoirs by individual households, and on changes in public opinion regarding water issues following the crisis. The Milford and Acton data confirm several findings from an earlier study (Hamilton, 1983a) regarding the underlying 'types' of conservation behavoir, and their demographic and attitudinal predictors. The Milford data also supported earlier conclusions that larger users make the largest absolute reductions, but middle-use households make reductions that represent a larger percentage of their total consumption. In addition, these data show that discoveries of chemical contamination are viewed with considerable alarm among the general public, and there is broad support for strong remedial measures. Town officials who took such measures met with public approval. Water resources planning and protection

become high-priority issues in the wake of a contamination incident.
W86-02496

INCENTIVES FOR INDUSTRIAL CONVERSION TO SURFACE WATER,
Mississippi State Univ., Mississippi State. Div. of Business Research.
L. R. Cheatham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214989/AS, Price codes: A08 in paper copy, A01 in microfiche. Mississippi Water Resources Research Institute, Mississippi State, Technical Completion Report, September 1984, 151 p, 2 exhibits, 31 tab, 45 ref. USGS G-851-04.

Descriptors: *Ground water management, *Mississippi, *Overdraft, *Water policy, *Industrial development, Economic aspects, Water demand, Legislation, Water allocation, Water costs,.

The purpose of this study was to investigate alternative incentives which may be capable of inducing industrial firms, especially those classified as large volume water users, to convert to surface water for all or a major portion of their needs. Various legal restrictions and allocation rules applied to ground water overdraft situations in other states were evaluated for applicability to industrial users in Mississippi. State ground water law and ownership doctrine were investigated for impact they may have on ground water management policies and practices. Economics of water supply source selection for firms was examined to determine why they choose a public supply system, a self-supply ground water system and/or a self-supply surface water system. Existing water user firms in the state as well as national corporate offices were surveyed to determine types of feasible incentives along with potential undesirable economic side effects when present. A summary selection of the most promising legal and economic incentives was prepared for Mississippi along with justifications and limitations of each tool.
W86-02501

COMPLEXITY AS A MEASURE OF SIMULATION MODEL APPROPRIATENESS: COLUMBIA RIVER CONFLICT AS A CASE STUDY,
Washington Univ., Seattle. Dept. of Civil Engineering.
J. L. Cohan, R. N. Palmer, and D. P. Lettenmaier.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215093/AS, Price codes: A07 in paper copy, A01 in microfiche. Technical Completion Report No. 89, Washington Water Resources Research Institute, Pullman, August 1984. 135 p, 33 fig, 9 tab, 53 ref, append. USGS G876-05.

Descriptors: *Mathematical models, *Washington, *Water demand, Model complexity, Monte Carlo simulation, Hydropower production, Fish production, *Conflict resolution, Planning, Model studies.

This report addresses the problem of simulation model complexity in water resource systems planning. The level of complexity incorporated into a model is shown to be a primary determinant of the value of the model for use in decision-making. This is illustrated with a review of models being applied for management of the conflict between fish production and hydropower production in the Columbia River Basin. A two-part test is proposed for determining whether a model has incorporated an appropriate degree of complexity and is applied to the models reviewed. It is concluded that the models currently used to generate trade-offs between conflicting uses of water in the basin are too complex for conflict resolution.
W86-02512

TEMPERATURE REQUIREMENTS OF PACIFIC COASTAL STREAM FISHES,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
For primary bibliographic entry see Field 5C.
W86-02568

DESIGN OF A DROUGHT MANAGEMENT EXERCISE: SIMULATION GAMING APPLIED TO THE INDIANAPOLIS WATER SUPPLY SYSTEM,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 6A.
W86-02580

COMPARISON OF FRESHWATER USE CUSTOMS ON ULITHI ATOLL WITH THOSE OF SELECTED OTHER MICRONESIAN ATOLLS,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
For primary bibliographic entry see Field 3B.
W86-02598

PROJECTIONS OF WATER AVAILABILITY IN THE AWR AND PECOS RIVER BASINS TO THE YEAR 2005,
New Mexico Univ., Albuquerque. Bureau of Business and Economic Research.
J. C. Tysseling, and B. McDonald.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-229789/AS, Price codes: A11 in paper copy, A01 in microfiche. Technical Completion Report, New Mexico Water Resources Institute Las Cruces, October 1984, 218 p, 69 tab, 34 ref, append. USGS G-858-05.

Descriptors: *New Mexico, *Available water, Water demand, *Economic growth, Water requirements, Water supply.

The management of New Mexico water resources requires an understanding of the magnitude of future water scarcity conditions so that planning can be provided which attempts to mitigate social costs associated with competition for available water supplies. Current and projected water supply and demand conditions are analyzed here for the Arkansas, White and Red River (AWR) and the Pecos River Basins in eastern New Mexico based on 1980 economic, demographic, and water use information. The combination of 1980 water use data reported by the State Engineer and economic and demographic data (provided by several sources) allows calculation of water use coeefficients per unit of economic activity and per capita water demand requirements. The analysis is provided for each county served by the water resources of the two basins. Future water scarcity conditions are assessed at both the county and basin-wide level in relation to 1980 water supplies and potential increases in those supplies as identified by the State Engineer. Evident from the analysis is the limited growth and corresponding limited increased water scarcity conditions, which are expected to be found in the AWR Basin by 2005. In contrast, growth in the economy and population of the Pecos River Basin, and particularly the southern portion of that basin, results in significant demand increases in a region which for many years has been experiencing water scarcity conditions. Uncertainties with respect to future water supplies and demands are also identified for these two water basins.
W86-02607

WATER-USE COEFFICIENTS AND RESOUCE MULTIPLIER FOR OAHU, HAWAII,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
R. L. Bowen, P. S. Leung, and M. H. Vesenka.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232841/AS, Price codes: A03 in paper copy, A01 in microfiche. Hawaii Water Resources Research Center, Technical Report 164, August, 1984. 36 p, 12 tab, 1 fig, 24 ref, append. USGS G838-06. 14-08-0001-G838.

Descriptors: *Input-outcome analysis, *Leontief models, *Water use, Model studies, *Hawaii, Input-output model, Water use coefficients, Water multipliers, Oahu.

The proliferation of the number of water multipliers in recent years has increased the likelihood that misunderstanding and misuse will occur by practitioners not well trained in the interindustry analysis. What is needed is a more standardized terminology and a more critical evaluation of the meaning and use of these multipliers. To this purpose, water resources multipliers were estimated for Oahu, and the usefulness of such multipliers for public planning and decision making in Hawaii are critiqued. The method of analysis used is the Leontief input-output or interindustry model. The Oahu model was developed from data used to construct the state input-output (I-O) model. Water use by economic sector was estimated from primary and secondary data. Three general types of water multipliers were estimated and evaluated for Oahu. The water-final demand coefficients can be useful in estimating water use under alternative development scenarios. The water-own multiplier was found to have limited value for planning in Hawaii. The water-income ratio is supposed to quantify the tradeoff between sectoral income and water use. However, this ratio is conceptually troublesome and it takes multiplier analysis beyond its traditional positive role into the normative arena.
W86-02629

METHODOLOGY TO INCREASE PRECISION IN MEASUREMENT OF IRRIGATION EFFICIENCY,
Kansas Water Resources Research Inst., Manhattan.
R. D. Black, H. L. Manges, and D. B. Erickson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233047/AS, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, September, 1984, 47 p, 16 fig, 6 tab, 15 ref, 6 equations, 2 append. USGS G843-03.

Descriptors: *Kansas, Irrigators, Irrigator information, Enterprise information, *Water management information, Field information, *Groundwater management, Questionnaires, Water meters, *Water rights.

A twenty percent sample of the total population of 537 irrigators in the Equus Beds Groundwater Management District No 2 in south central Kansas was selected at random and surveyed. Data were obtained on a questionnaire administered by personal interview in four categories: irrigator information, farming enterprise information, water management information, and individual field information. The irrigators of the study area are a middle-aged group(52 years) on modest sized (< 500 acres or less) family farms. They grow and irrigate the common crops of the region: Wheat, grain sorghum, soybeans and corn. They are rather new in irrigation with about half having ten years or less experience but they have farmed all their lives, average 33 years. There is much room for improvement, but one third have water meters and nearly one quarter measure soil moisture and use consulting services to schedule irrigation. They do not, as a group, use all the water their water rights would permit. The twenty percent sample was generally large enough to measure the average response within plus or minus 10 percent error at a confidence limit of 95 percent. Procedures were found in the literature which, when combined with this data base, will allow estimates of sample size required for other irrigation surveys. The results also point out areas of questioning where the answers will most probably contain large errors unless the entire population is sampled.
W86-02649

APPLICABILITY OF MICROCOMPUTERS FOR MANAGING WATER IN SMALL RIVER BASINS,
Portland State Univ., OR. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6E.
W86-02681

6E. Water Law and Institutions

LEGAL CONSTRAINTS ON ALASKA'S WATER RESOURCE MANAGEMENT,

Alaska Univ., Fairbanks. Inst. of Water Resources.
R. E. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214732/AS, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 184-15, September, 1985. 20 p. USGS G827-06.

Descriptors: Laws, Legal aspects, Planning, Prior appropriation, *Water Law, *Alaska, *Legal constraints.

Alaska has a modern and efficient Water Use Act. From the position of western water law the Water Use Act is the most recent stage in the evolution of prior appropriation. The administration of both surface and groundwater as part of the same system is a major advantage over most western states. Alaskan communities, near population centers, are experiencing shortages in groundwater and some streams are over appropriated. The current program to establish the navigability of Alaska's water courses is most valuable and should establish new criteria as to what constitutes navigability for title. Large scale water transfers are becoming a modern reality with the Eklutna Water Project. The state needs to institute adequate safeguards to insure against undesirable transfers of water.
W86-02476

VOLUNTARY BASINWIDE WATER MANAGEMENT: SOUTH PLATTE RIVER BASIN, COLORADO,
Colorado Water Resources Research Inst., Fort Collins.
For primary bibliographic entry see Field 6A.
W86-02482

INSTITUTIONAL FRAMEWORK FOR CONJUNCTIVE USE OF SURFACE AND GROUND WATER,
Mississippi Univ., University. Bureau of Governmental Research.
R. E. McArthur, and D. B. Brammer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214906, Price codes: A05 in paper copy. A01 in microfiche. Mississippi University, Mississippi State Water Resources Research Institute, Technical Completion Report, September, 1984. 72 p, 41 ref, 3 append. USGS G851-02.

Descriptors: *Mississippi, *Management planning, *Institutional constraints, *Conjunctive use, Groundwater management, Water supply, Groundwater availability, Surface water availability.

Officials and citizens in two Mississippi counties considered their water supply situations, including proposals for alternative institutional arrangements for financing and managing water systems which would provide conjunctive use of surface and ground water to furnish more dependable water supplies and to protect the underlying aquifer from further decline. At the request of the Appalachian Regional Commission and the Tombigbee River Valley Water Management District, two engineering studies were undertaken earlier to determine the potential for ground and surface water resources in Alcorn and Lowndes counties, as well as economic constraints on development of those resources. This report concerns governmental factors which might affect the implementation of the recommendations suggested in those engineering studies. The research objectives were: (1) to analyze current relevant institutional arrangements which affected water resources planning and management in each county; (2) to present a Model Institutional Framework to encourage conjunctive use; and (3) to propose a program of action to implement the Model Institutional Framework.
W86-02493

INCENTIVES FOR INDUSTRIAL CONVERSION TO SURFACE WATER,
Mississippi State Univ., Mississippi State. Div. of Business Research.
For primary bibliographic entry see Field 6D.
W86-02501

POVERTY, POWER AND WATER RESOURCES ON THE PAPAGO RESERVATION,
Arizona Univ., Tucson. Dept. of Political Science.
H. M. Ingram, T. R. McGuire, and M. Wallace.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-229714/AS, Price codes: A09 in paper copy, A01 in microfiche. Arizona Water Resources Research Center Completion Report, Tucson, Sept 1984. 170 p, 1 map, 15 tab, 153 ref. USGS G828-06.

Descriptors: *Indian water rights, *Legislation, Water development, Policy making, Political aspects, Public opinion, Groundwater management, *Arizona.

The relationship between poverty, lack of political power, and water resources on the Papago Reservation is examined. Through an examination of anthropological literature, the public record of newspaper reports, Congressional hearings, agency documents, and personal interviews with important actors, the report establishes the historic lack of Papago influence over water allocation and management in Southern Arizona. It finds that lack of Papago participation is the root cause of underdevelopment of the economy on the reservation. The Southern Arizona Water Rights Settlement Act of 1981 establishes how water resources can become a vehicle for enhanced Papago participation. A variety of alternative uses for Papago water are analyzed. Taking into account the responses of Papago people to several opinion surveys, the report recommends certain strategies for utilizing water and for coping with the political environment external to the reservation affecting water allocation and management.
W86-02600

NEW MEXICO WATER RIGHTS,
New Mexico Water Resources Research Inst., Las Cruces.
L. G. Harris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-229763/AS, Price codes: A04 in paper copy, A01 in microfiche. Miscellaneous Report No. 15, March 1984. 54 p, 4 fig. USGS G858-23.

Descriptors: *Water law, *New Mexico, *Water rights, Riparian rights, Appropriation, Reservation Doctrine.

This booklet summarizes water rights concepts in general, and specifically, how those concepts apply to water law in New Mexico. Topics covered include: a historical perspective of water, the nature of water, the riperian doctrine of water use, the doctrine of prior appropriation, what is a water right, constraints on water rights, how to obtain a water right, water rights transactions, and penalities for the misuse of water. In addition, the book contains a glossary of water terms and a resource list of references and agencies for further information.
W86-02605

REPPUN V. BOARD OF WATER SUPPLY: PROPERTY RIGHTS, ECONOMIC EFFICIENCY AND ENSURING MINIMUM STREAMFLOW STANDARDS,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
W. B. C. Chang, and J. E. T. Moncur.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232874/AS, Price codes: A04 in paper copy, A01 in microfiche. Hawaii Water Resources Research Center Technical Report 165, Honolulu, Sept. 1984. 45 p, 1 tab, 14 ref. USGS G838-04. 14-08-0001-G838.

Descriptors: *Water rights, *Public Trust Doctrine, *Water transfer, Economic efficiency, Streamflow, Riparian rights, *Hawaii, Reppun v. Board of Water Supply, Riparian Doctrine, Public Use Doctrine.

Two recent decisions of the Hawaii Supreme Court have substantially modified the ground rules governing water rights in the state. The principal economic result of these decisions is the limitations they impose, if they survive appeals, on rights of individual water users to exchange water rights. This report inquiries into the values the Court appears to have had in mind in imposing such restrictions. From a legal standpoint, the paper argues that the Court's decision in Reppun v. Board of Water Supply sought not so much to protect the taro famers from loss of water as to protect in-stream water uses such as fishing and aesthetics. A brief summary of the economics of growing taro in Waihee Valley suggests that the water in question has much higher-valued uses than traditional taro cultivation, and notes a broad framework of principles that would allow efficient allocation of water between users, uses and places of use, covering traditional as well as in-stream uses.
W86-02632

IMPROVING EFFECTIVENESS IN PLANNING AND EQUITY FINANCING OF STATE WATER RESOURCES MANAGEMENT,
Kansas Water Resources Research Inst., Manhattan.
J. C. Peck, and R. L. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232981/AS, Price codes: A07 in paper copy, A01 in microfiche. Kansas Water Resources Research Institute Completion Report, Manhattan, January 1985, 124 p, 11 ref, 3 append. USGS G843-06.

Descriptors: *Water resources planning, *Kansas State government expenditures, Project development, Cost recovery, Administrative costs, Property tax, Severence tax, Ad valorem tax, *Water rights, Groundwater, Irrigation.

An analysis of the nature and scope of state water resources planning programs is undertaken. The results clearly indicate state water planning programs can and should serve more than project development issues. Typically, state government expenditures in water resources management can be classified under broad functional headings of planning, regulation, data collection and research and physical project development. It is concluded that the best opportunities for significant cost recovery of state water management efforts are found within the regulatory and project development functions. The possibility of recovering administrative costs via a tax or fee related to water rights is explored. Other states tax water rights in various ways, the most common method as a tax on real property, since a water right is generally deemed to be a real property interest appurtenant to land. Water is sometimes taxed based on the amount of withdrawal. Kansas arguably taxes water rights as part of its ad valorem tax on real property and as part of the groundwater management district water use charges. The Kansas severence tax does not include water as a mineral to be taxed. Under the Kansas property tax, water rights are not expresssly included in the tax, and practice varies widely throughout the state. The water right is not even noted in eastern Kansas, while it is more often included in the assessment in western Kansas where groundwater is used for irrigation. The legislature could amend Kansas laws to clearly include water rights as part of property taxes, and it could enact a separate tax on water withdrawals as a kind of exise or pump tax.
W86-02643

APPLICABILITY OF MICROCOMPUTERS FOR MANAGING WATER IN SMALL RIVER BASINS,
Portland State Univ., OR. Dept. of Civil Engineering.
R. W. Koch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-248011/AS, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Publication WRRI-97, Corvallis, August 1984. 51 p, 6 fig, 6 tab, 20 ref. USGS G864-07. 14-08-0001-G-864.

Descriptors: *Water management, *Water use, *Water rights, *Water allocation, Available water, Computers, *Computer applications, Computer models, Modeling, Routing, *Streamflow routing, Soil moisture, Soil water, Tualatin River Basin, *Oregon.

The task of managing water resources under the appropriative system of water rights normally is one of simply assuring that the legal priority is satisfied. To maximize availability of water in a tightly constrained system requires the cooperation of users by increasing their efficiency of water use. To accomplish this, information on the best timing and amount of water application is required. To aid the local individual such as a watermaster or irrigation district manager in making decisions and providing information to water users on water availability, given the complex nature of the hydrologic system, software has been developed in this project to allow the necessary analysis. Water rights information such as priority date, location, amount of use, and type of use is computerized in combination with descriptions of the water use component, principally irrigation, and the river system. The water use component accounts for soil moisture while the river model accounts for the time-varying reaction of streamflow to various water withdrawals and inflows. The application of efficient computer algorithms allows use of the microcomputer. Applying these models, the water manager can investigate the effects of decisions regarding water distribution as well as provide short-term forecasts of demand and availability to aid the water users in increasing their efficiency, thus providing greater supply.
W86-02681

HYDROLOGIC AND LEGAL ASSESSMENT OF GROUND WATER MANAGEMENT ALTERNATIVES FOR IDAHO,
Idaho Univ., Moscow. Coll. of Mines and Earth Resources.
For primary bibliographic entry see Field 4B.
W86-02687

DEVELOPMENT AND IMPLEMENTATION OF A PROCEDURE TO RESOLVE TRANSBOUNDARY ISSUES BETWEEN MONTANA AND THE CANADIAN PROVINCES OF ALBERTA, SASKATCHEWAN AND BRITISH COLUMBIA,
Montana State Univ., Bozeman. Forty-Ninth Parallel Inst.
C. Martin, A. Stanley, S. Maly, and L. McKinsey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101276/AS, Price codes: A03 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Bozeman, Report No. 144, 1985. 34 p, 99 ref. USGS G-853-06. 14-08-0001-G-853.

Descriptors: *International disputes, *International waters, *Treaties, Equitable apportionment, *Water allocation(Policy), *International Joint Commission, Canada, Montana, Administrative agencies, Transboundary water issues, *Intergovernmental relations, *Boundary Waters Treaty.

Four separate international river basin issues affect Montana and three neighboring Canadian provinces. Several federal and state government agencies are involved, usually on an intermittent ad hoc and reactive basis. Gaining results has been costly, time-consuming, and not always satisfactory to U.S. interests. This project explored an alternative strategy for more effective monitoring and resolution of river basin issues. The research design consisted of two phases. The first phase involved building a process for mediating transboundary water issues between Montana and the bordering provinces. The second phase was to test the process on two critically important transboundary water issues in the Milk/St. Mary and Poplar River Basins. The results of the project included recommendations for future negotiations, establishing a clearinghouse for inter-governmental negotiations, establishing a task force to respond to Canada's initiatives on the Milk River, and a positive response to the International Joint Commissions recommendations on the Poplar River.
W86-02708

6G. Ecologic Impact Of Water Development

DESIGN AND MANAGEMENT OF IRRIGATION PROJECTS FOR THE SUSTAINED BENEFIT OF WILDLIFE: A BIOECONOMIC ANALYSIS OF THE EAST HIGH AREA OF THE COLUMBIA BASIN PROJECT,
Washington State Univ., Pullman. Dept. of Agricultural Economics.
S. C. Matulich, J. E. Hanson, and J. Buteau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211696/AS, Price codes: A13 in paper copy, A01 in microfiche. State of Washington Water Research Center, Pullman, Technical Completion Report No. 53, November, 1983. 276 p, 20 tab, 56 fig, 59 ref, 4 append. OWRT B-086-WASH(1). 14-34-0001-9160.

Descriptors: Wildlife habitat enhancement, *Wildlife management, Planning, *Irrigation effects, Environmental effects, *Economic analysis, *Washington, *Columbia Basin, Irrigation project, Mallards, Pheasant, Model studies, Bioeconomic models, Cost effectiveness, Habitat evaluation procedures.

A bioeconomic modeling framework is developed to incorporate wildlife habitat enhancement planning into the proposed East High area of Washington's Columbia Basin Irrigation Project. The planning framework developed here provides the essential linkage between modeling the biological response to habitat manipulation, and an economic criterion to choose among alternative habitat management strategies or plans. The Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service served as the biological response model. However, HEP was expanded/linked to technically feasible habitat management actions and a mathematical programming model to determine alternative cost effective enhancement plans. The modeling procedure is detailed. Empirical analysis targeted breeding habitat enhancement for the mallard (Anas platyrhynchos) and year-round habitat enhancement for the ring-necked pheasant (Phasianus colchicus). Centralized, off-farm enhancement opportunities were investigated on three land strata: unirrigable class 6 lands, the carriage and distribution system, and miscellaneous class 1 to 3 irrigable lands. The most significant and cost effective enhancement opportunity was found to be on unirrigable lands. To a large extent, this finding is a consequence of the unique physiographic features of the project setting. Both project specific and general enhancement recommendations are made.
W86-02440

BIOHYDROLOGY OF MOUNTAIN FLUVIAL SYSTEMS: THE YELLOWSTONE (PARTS I AND II),
Montana Univ., Missoula.
A. J. Silverman, and W. D. Tomlinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211811, Price codes: A99 in paper copy, E04 in microfiche. Montana Water Resources Research Center Completion Report 147, December, 1984. G91 p, 17 tab, 16 fig, 3 append. USGS G-853-02.

Descriptors: Riparian waters, Riparian land, Riparian plants, Surface water, Water quality, Fisheries, Wildlife, Amphibians, Mammals, Reptiles, Birds, *Yellowstone River, Riparian zone, *Riparian ecology, Water withdrawals, *Montana.

This project compiled principal research and investigative reports that have been performed on the Yellowstone River, and has organized and annotated them in a uniform fashion. From this informational base some insights into the character and function of the Yellowstone riparian community have developed as well as some perspective of historical extent, current size, activities influencing its condition and mechanisms for mitigating loss and damage to the zone, particularly prime river bottom cottonwood. The report text consists of nine chapters pertaining to 1) general riparian zone properties, form and function; 2) geology and geomorphology of the river; 3) history of cultural activity and resources of the Yellowstone; 4 & 5) Yellowstone River riparian vegetation and wildlife; 6) the river's fisheries; 7) river based recreational use and trends; 8) threats to the Yellowstone river and its riparian zone; and 9) riparian protective or mitigative measures. The report also contains a series of matricies that display occurrence, distribution, use, and current status information for the birds, mammals, reptiles, and amphibians found in the 7 latilongs through which the Yellowstone flows.
W86-02452

EFFECT OF HYDROPERIOD ON FLOODPLAIN FOREST PRODUCTION,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 2I.
W86-02462

WETLANDS AND COAL SURFACE MINING: A MANAGEMENT HANDBOOK WITH PARTICULAR REFERENCE TO THE ILLINOIS BASIN OF THE EASTERN INTERIOR COAL REGION,
Kentucky Water Resources Research Inst., Lexington.
M. A. Cardamone, J. R. Taylor, and W. J. Mitsch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214682/AS, Price codes: A06 in paper copy, A01 in microfiche. Research Report No 154, September 1984. 113 p, 15 fig, 6 tab, 65 ref, append. G-844-23.

Descriptors: Wetlands, Coal surface mining, Ecosystems, *Kentucky, *Environmental protection.

This report outlines management operation for protecting wetlands during the surface mining of coal, particularly for the portion of the Eastern Interior Coal Region that is found in Kentucky, Indiana, and Illinois. It is presented in manual form for use by coal mine operators, regulatory agencies and research institutions. The previous phases of the project produced an atlas of the most heavily-mined areas of the western Kentucky coal field, which classified and identified wetlands in these areas, and discussed some specific impacts of mining on these wetlands. The need to present information that will lead to action by coal operations and regulatory agencies to protect wetland areas, is the incentive for this work. The main issues addressed in this manual include: basic information for identifying wetlands; wetland values, and methods used for values assessment; how coal mining can affect wetlands; a method for addressing wetland protection needs and some prevention and mitigation actions; reclamation alternatives, including wetland restoration and the creation of wetlands as alternative ecosystems on mined areas; and general legal and regulatory information concerning wetland protection and surface mining of coal. Information was gathered through a search of current literature and by contact with state and federal agencies, some coal mining operations, and other concerned organizations. A detailed listing of places to go for more information is included.
W86-02471

AQUATIC RESOURCES MANAGEMENT OF THE COLORADO RIVER ECOSYSTEM: PROCEEDINGS OF THE 1981 SYMPOSIUM ON THE AQUATIC RESOURCES MANAGEMENT OF THE COLORADO RIVER ECOSYSTEM, NOVEMBER 16-18, 1981, LAS VEGAS, NEVADA,
Utah Water Research Lab., Logan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214815/AS, Price codes: A99 in paper copy, E04 in microfiche. Ann Arbor Science, Ann Arbor, MI. 1983. 697 p. Edited by V.D. Adams and V.A. Lamarra. OWRTC-00176-T. 14-34-001-0518.

Descriptors: *Environmental effects, *Watershed management, Reservoirs, *Ecosystems, Rivers, *Aquatic habitats, *Water quality, *Oil shale, *Sa-

linity, Fish management, Economic aspects, Legal aspects, Wildlife, Aquatic life, Recreation, Lakes, Water rights, *Colorado River, Mountain watersheds, Water management, Weather modificaton, Cloud seeding, Nutrients, Phosphorus, Algae, Energy, Lake Powell, Lake Mead, Arid lands.

The symposim addresses the problems confronting managers of the Colorado River system, which has been called the most regulated river system in the world. Millions of people in 7 relatively arid states and Mexico depend on this water resource for irrigation, municipal and industrial water supplies, energy development, fish and wildlife activities, and recreation. Topics included in the symposium are reservoirs (operation, effects on water quality, nutrients), main streams (effects of recreation on the ecosystem, availability of phosphorus to algae, characterization of tributaries), weather modification by cloud seeding in the watershed, oil shale development (effect on ecosystems and water quality), salinity (source, fate, and control), fisheries management, and economic and legal aspects.
W86-02484

CONTROL OF ALGAL DOMINANCE THROUGH CHANGES IN ZOOPLANKTON GRAZING, LAKE WASHINGTON: PHASE II,
Washington Univ., Seattle. School of Fisheries.
H. J. Hartmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215119/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, August 1984. 53 , 17 fig, 7 tab, 18 ref. USGS G876-08.

Descriptors: *Fish behavior, *Washington, *Algae, *Zooplankton grazing, Selective feeding, Feeding morphology, Zooplankton-phytoplankton interactions, Phosphorus recycling, Phytoplankton species succession, Daphnia pulicaria, Diaptomus ashlandi, stephenodiscus hantzschii, ankistrodesmus sp., Oscillatoria aghardii, Lake Washington, Claderocerans, Copepods, Diatoms, Blue-green algae, Water clarity.

Food gathering and selective grazing behavior of the calanoid copepod Diaptomus ashlandi and the cladoceran pulicaria from Lake Washington were compared as part of a larger study that examines the grazing and phosphorus-recycling roles of pelagic lacustrine zooplankton in relation to phytoplankton abundance and species succession. Proportionally mixed double-isotope (32P-33P) labeled pairs of a diatom (stephanodiscus hantzschii), a green alga (ankistrodesmus sp.) and a filamentour blue-green bacterium (Oscillatoria aghardii) were fed to Diaptomus copepodites to measure clearance and ingestion rates and examine selectivity behavior. Both grazers preferred Stephanodiscus over Ankistrodesmus, but the feeding niches were separated along boundaries determined by totl algal biomass and the relative abundance of each alga. When algal density was great (>1000 cells/ml), Diaptomus selected for Stephanodiscus to a greater extent than Daphnia. With lower algal density (< 1000 cells/ml), or when Stephanodiscus were relatively common (>60% of total algal biomass), Daphnia selected the diatom more consistently than Diaptomus. Oscillatoria strands interfered with the feeding of small neonate Daphnia, but not with larger adult Daphnia or Diaptomus. The divergent feeding behavior patterns were interpreted through scanning microscope examination of the animals' feeding morphologies.
W86-02514

STUDY OF THE MECHANICS OF GROUNDWATER AQUIFER/AQUITARD EXPANSION CAUSED BY HEATING,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W86-02553

DISTRIBUTION OF DENITRIFYING AND SULFATE REDUCING BACTERIA WITHIN A RIPARIAN ZONE ALONG A MOUNTAIN STREAM,
Wyoming Univ., Laramie. Coll. of Agriculture.
Q. D. Skinner, and J. C. Adams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-229748/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, Wyoming, Water Research Center, Laramie, October 1984. 69 p, 3 fig, 7 tab, 78 ref, 6 append. USGS G879-07.

Descriptors: *Wyoming, *Soil bacteria, *Forest hydrology, Bacteria, Distribution patterns, Riparian vegetation, Soil environment, *Nashfork Hydrological Observatory, *Medicine Bow National Forest, *Telephone Creek.

The presence and activity of denitrifying bacteria, as well as bacteria capable of reducing sulfate in one upland and five riparian soils of a mountain watershed in Wyoming, were studied during the summer and fall of 1983. Research was conducted on the Nashfork Hydrologic Observatory west of Laramie, Wyoming within the Medicine Bow National Forest. A 30 x 100 m study site was located along Telephone Creek 40 m upstream from a stream flow gaging station. Bacteria were enumerated from soil samples collected along transects placed perpendicular to stream flow across three plant communities; wet meadow, moist meadow, and upland. Soil samples were taken from 5, 15, and 30 cm below the soil surface. Six sampling periods were utilized to develop the database, three during August and three during September. Soils were characterized by soil water content, soil pH, and percent organic matter. This study found that: 1) Nitrous oxide production was higher at 5 cm than at 15 or 30 cm for the soils of riparian habitat in a high mountain watershed; 2) Nitrous oxide production appeared greater in soils containing more organic matter, higher water contents, and located nearer to the stream; 3) Denitrifying, sulfate-reducing, and heterotropic aerobic bacteria appeared more abundant at 5 to 15 than at 30 cm depths, and, in general, increased with proximity to stream side; and 4) Organic matter content and water content increased with decreasing depth and proximity to the stream edge. The greater apparent abundance and activity of microorganisms in close proximity to the edge of the stream indicates that these soils could be of importance in protecting and regulating nutrient inputs to the stream from adjacent lands.
W86-02603

COMPARISON OF HABITATS NEAR SPUR DIKES, CONTINUOUS REVETMENTS, AND NATURAL BANKS FOR LARVAL, JUVENILE, AND ADULT FISHES OF THE WILLAMETTE RIVER,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
H. W. Li, C. B. Schrenck, and R. A. Tubb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-246783/AS, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute Publication WRRI-95, Corvallis, September 1984. 15 p, 7 tab, 18 ref. USGS G864-05. 14-08-0001-G-864.

Descriptors: *Aquatic habitats, Habitats, Riprap, *Bank protection, *Bank stabilization, Aquatic life, *Stream fisheries, Fish, Aquatic ecosystems, Alluvial rivers, Stream banks, Dikes, Spur dikes, Revetments, *Ecological effects, *Willamette River, Oregon.

Natural banks, because they are diverse in structure, afford the best habitat for resident fishes of the mid-Willamette River. Spur dikes contain a diversity of habitats, in terms of velocities, depths, and cover, that is unavailable at continuous revetments. The numbers of species of fishes and the densities of larval and juvenile fishes at spur dikes are intermediate between those at natural banks and at continuous revetments. The numbers of species of adult fishes found were similar at spur dikes and continuous revetments. Juvenile chinook salmon were found to use the slack water between spur dikes during early spring but were not captured near continuous revetments. Wood debris was observed to accumulate between spur dikes. As more debris accumulates and riparian vegetation develops, habitat for adult fishes should improve, especially during the winter. Relationships between habitat variables and juvenile fish density changed between major sampling periods. This is due to changes in habitat needs during fish growth, but also reflects that physical gradients such as temperature and velocities became less severe as time passed. Two factors were consistent: juvenile fishes avoided velocities greater than 11 cm/sec and were found at depths not greater than 30 cm.
W86-02672

FISH ABUNDANCE UPSTREAM FROM DWORSHAK DAM FOLLOWING EXCLUSION OF STEELHEAD TROUT,
Idaho Univ., Moscow. Dept. of Fish and Wildlife.
C. M. Moffitt, and T. C. Bjornn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249167/AS, Price codes: A04 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute, Moscow, Completion Report, June, 1984. 54 p, 5 fig, 3 tab, 8 ref. USGA G839-04. 14-08-0001-G839.

Descriptors: *Idaho, *Anadromous fish, *Trout, *Dam effects, *Fish barriers, Fish population, Fish management, Dworshak Dam.

Fish abundance was determined by underwater fish counts in selected locations on twelve tributary streams of the North Fork Clearwater River, Idaho. Fish numbers, species composition and fish density were compared to results from previous studies of the watershed to determine what changes have occurred in the fish populations fifteen years after anadromous fish were excluded from the watershed by the construction of Dworshak Dam. Rainbow trout, Salmo gairdneri, continue to be the most abundant species in most tributaries of the North Fork Clearwater River. Average fish densities have decreased markedly since the elimination of anadromous forms of rainbow trout (steelhead trout). Historically, large numbers of juvenile steelhead trout utilized the habitat in the tributaries of the North Fork of the Clearwater River, but resident forms of rainbow and cutthroat trout, Salmo clarki, are not fully utilizing this space. Further studies to increase the potential for fish production are suggested, including evaluation of introducing adfluvial or later-maturing stocks of rainbow and cutthroat trout.
W86-02695

GROUND-WATER CONDITIONS IN AND NEAR THE GILA RIVER INDIAN RESERVATION, SOUTH-CENTRAL ARIZONA,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02804

SALINITY CHARACTERISTICS AND DISTRIBUTION AND EFFECTS OF ALTERNATIVE PLANS FOR FRESHWATER WITHDRAWAL, LITTLE MANATEE RIVER ESTUARY AND ADJACENT AREAS OF TAMPA BAY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 2L.
W86-02883

7. RESOURCES DATA

HARMONIC ANALYSES OF STREAM TEMPERATURES IN THE UPPER COLORADO RIVER BASIN,
Geological Survey, Lakewood, CO. Water Resources Div.
T. D. Steele.
Available from: OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4290, 1985. 51 p, 9 fig, 10 tab, 20 ref.

Descriptors: *Time series analysis, *Water temperature, Regional analysis, Stream temperature, Upper Colorado River Basin, Harmonic analysis, *Piceance Basin, *Colorado River Basin.

Harmonic analyses were made for available daily water-temperature records for 36 measurement sites on major streams in the Upper Colorado River Basin and for 14 measurement sites on streams in the Piceance structural basin. Generally (88 percent of the station years analyzed), more than 80 percent of the annual variability of temperatures of streams in the Upper Colorado River Basin was explained by the simple-harmonic function. Significant trends were determined for 6 of the 26 site records having 8 years or more record. In most cases, these trends resulted from construction and operation of upstream surface-water impoundments occurring during the period of record. Regional analysis of water-temperature characteristics at the 14 streamflow sites in the Piceance structural basin indicated similarities in water-temperature characteristics for a small range of measurement-site elevations. Evaluation of information content of the daily records indicated that less-than-daily measurement intervals should be considered, resulting in substantial savings in measurement and data-processing costs. (USGS)
W86-02917

7A. Network Design

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
I. L. Burmeister, and O. G. Lara.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4171, 1984. 66 p, 11 fig, 3 tab, 22 ref.

Descriptors: *Hydrologic data collections, *Network design, *Cost-benefit analysis, *Operating costs, Optimization alternative planning, Scheduling, *Iowa.

Data uses and funding sources were identified for the 122 surface-water stations (including reservoir, lake, stage only, and miscellaneous stations) operated by the U.S. Geological Survey in Iowa. There are 110 continuous streamflow stations currently being operated in Iowa with an annual budget of $592,000. The average standard error of estimation in continuous-streamflow records is 11.4 percent. Under the existing budget, it was shown that this overall degree of accuracy at the 110 continuous streamflow stations could be improved to 10.5 percent if the gaging schedule was optimized. A minimum budget of $543,000 is required to operate the present stream-gaging program in Iowa, with an average standard error of 12.5 percent. The maximum budget analyzed was $1,235,000, which resulted in an average standard error of 4.2 percent. A realistic budget of $656,000 would result in a standard error of 8.4 percent. There are still a few basins with drainage areas greater than 200 square miles that have no continuous streamflow data. Continuous streamflow stations need to be established in these basins as funds become available. Data simulated by using the flow-routing and regression methods for stations in six river basins do not meet the accuracy required for their data use. (USGS)
W86-02773

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NORTHEASTERN CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
S. H. Hoffard, V. F Pearce, G. D. Tasker, and H. W. Doyle.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4127, 1984. 107 p, 13 fig, 39 tab, 17 ref.

Descriptors: *Hydrologic data, Stream gages, *Stream discharge, *Data collections, *California, Program analysis, Uncertainty.

Results are documented of a study of the cost effectiveness of the stream-gaging program in northeastern California. Data uses and funding sources were identified for the 127 continuous stream gages currently being operated in the study area. One stream gage was found to have insufficient data use to warrant cooperative Federal funding. Flow-routing and multiple-regression models were used to simulate flows at selected gaging stations. The models may be sufficiently accurate to replace two of the stations. The average standard error of estimate of streamflow records is 12.9 percent. This overall level of accuracy could be reduced to 12.0 percent using computer-recommended service routes and visit frequencies. (USGS)
W86-02774

COST EFFECTIVENESS OF THE U.S. GEOLOGICAL SURVEY'S STREAM-GAGING PROGRAM IN ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
D. M. Mades, and K. A. Oberg.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4123. 107 p, 10 fig, 11 tab, 25 ref.

Descriptors: Error analysis, *Cost effectiveness, *Networks, Operating policies, *Optimization, *Stage-discharge relations, *Stream gages, *Streamflow, Operating costs, Rivers, Statistics, Data use, *Illinois, Kalman Filter, Streamflow routing.

Data uses and funding sources were identified for 138 continuous-record discharge-gaging stations currently (1983) operated as part of the stream-gaging program in Illinois. Streamflow data from five of those stations are used only for regional hydrology studies. Most streamflow data are used for defining regional hydrology, defining rainfall-runoff relations, flood forecasting, regulating navigation systems, and water-quality sampling. Based on the evaluations of data use and of alternative methods for determining streamflow in place of stream gaging, no stations in the 1983 stream-gaging program should be deactivated. The current budget (in 1983 dollars) for operating the 138-station program is $768,000 per year. The average standard error of instantaneous discharge for the current practice for visiting the gaging stations is 36.5 percent. Missing stage record accounts for one-third of the 36.5 percent average standard error. (USGS)
W86-02782

PRESENT AND PROPOSED GROUND-WATER LEVEL PROGRAM IN MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
J. T. Adamik.
Available from: OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report, 84-4235, 1984. 37 p, 11 il, 6 tab, 17 ref.

Descriptors: *Observation wells, *Network design, Aquifers, Groundwater, Water-level fluctuations, *Maine.

A statewide observation-well program was designed for Maine. Three networks were designed to provide reliable data to describe the effects of natural and manmade stress on water levels in the State. They are a climatic-effects network, a terrain-effects network, and a local-effects network. Review of the 32 observation wells in the current program showed that only 17 wells should be retained. Each of these wells was assigned to one of the three types of networks. Fourteen wells were deactivated because of reliability problems and one was deactivated because it provided redundant data. The installation of seven additional wells in climatic-effects network is the highest priority of the proposed program. The next priority is to install 22 additional wells in the terrain-effects network. Implementation of local-effects network sites will be responsive to increases in ground-water usage and the data needs of water-resources managers. (USGS)
W86-02788

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
G. B. Engel, K. L. Wahl, and J. A. Boohar.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4098, 1984. 76 p, 5 fig, 7 tab, 21 ref.

Descriptors: *Surface water, *Streamflow, *Gaging stations, *Cost analysis, Discharge measurements, *Nebraska, *Cost effectiveness.

This report documents the results of a study of the cost-effectiveness of the streamflow information program in Nebraska. Presently, 145 continuous surface-water stations are operated in Nebraska on a budget of $908,500. Data uses and funding sources are identified for each of the 145 stations. Data from most stations have multiple uses. All stations have sufficient justification for continuation, but two stations primarily are used in short-term research studies; their continued operation needs to be evaluated when the research studies end. The present measurement frequency produces an average standard error for instantaneous discharges of about 12 percent, including periods when stage data are missing. Altering the travel routes and the measurement frequency will allow a reduction in standard error of about 1 percent with the present budget. Standard error could be reduced to about 8 percent if lost record could be eliminated. A minimum budget of $822,000 is required to operate the present network, but operations at that funding level would result in an increase in standard error to about 16 percent. The maximum budget analyzed was $1,363,000, which would result in an average standard error of 6 percent. (USGS)
W86-02885

GEOHYDROLOGY AND GROUND-WATER QUALITY MONITORING NETWORK FOR THE LOWER MOJAVE RIVER VALLEY, CALIFORNIA,
Geological Survey, Santee, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02888

DESIGN OF A GROUND-WATER QUALITY MONITORING NETWORK FOR THE SALINAS RIVER DRAINAGE BASIN, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
P. Showalter, J. P. Akers, and L. A. Swain.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225 USGS Water-Resources Investigations Report 83-4049, 1984. 73 p, 10 fig, 5 pl, 10 tab, 21 ref.

Descriptors: *Groundwater hydrology, *Alluvial aquifer, *Surface-ground water relations, Water quality, *Network design, Monitoring, Geohydrologic units, *California, Salinas River basin, Paso Robles Basin, Monterey County, San Luis Obispo County.

A regional ground-water quality monitoring network for the entire Salinas River drainage basin was designed to meet the needs of the California State Water Resources Control Board. The project included phase 1--identifying monitoring networks that exist in the region; phase 2--collecting information about the wells in each network; and phase 3--studying the factors--such as geology, land use, hydrology, and geohydrology--that influence the ground-water quality, and designing a regional network. This report is the major product of phase 3. Based on the authors' understanding of the ground-water-quality monitoring system and input from local offices, an ideal network was designed. The proposed network includes 317 wells and 8 stream-gaging stations. Because limited funds are available to implement the monitoring network, the proposed network is designed to correspond to the ideal network insofar as practicable, and is composed mainly of 214 wells that are already being monitored by a local agency. In areas where net-

work wells are not available, arrangements will be made to add wells to local networks. The data collected by this network will be used to assess the ground-water quality of the entire Salinas River drainage basin. After 2 years of data are collected, the network will be evaluated to test whether it is meeting the network objectives. Subsequent network evaluations will be done very 5 years. (USGS)
W86-02909

7B. Data Acquisition

MEASUREMENT OF LOW FLOW VELOCITIES FOR SHALLOW BODIES OF WATER,
Vermont Univ., Burlington. Dept. of Civil and Mechanical Engineering.
J. P. Laible, and A. Booth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214559/AS, Price codes: A04 in paper copy, A01 in microfiche. Vermont Water Resources Research Center Completion Report, Burlington, December, 1984. 60 p, 6 fig, 20 ref, append. USGS G873-06.

Descriptors: Lakes, Shallow lakes, Currents, *Current measurement, *Velocity measurement, *Flow meters.

The development of a low cost, low velocity (0-15 cm/sec) current meter is described. Several low velocity current measurement techniques are also surveyed. The developed current meter uses a thermistor, operating in a low overheat quais-constant current mode, as the flow sensor. Velocity is determined by measuring the thermistor bead temperature by measuring the time to charge a capacitor through the thermistor between two known voltage levels. The useable velocity range was found to be 0-5 cm/sec making the probe useful for near bottom sampling but not for open flow situations. The limited velocity range can be avoided by converting the probe to a constant temperature mode using a microprocessor for positive control. Work on this technique is proceeding. Current direction is measured with a commercially available optically coupled direction head. The developed current meter is very low in cost, has a low power requirement and is suitable for remote operation.
W86-02459

USE OF INDUCED FLUORESCENCE MEASUREMENTS TO ASSESS ALUMINUM-ORGANIC INTERACTIONS IN ACIDIFIED LAKES,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5C.
W86-02529

DEVELOPMENT OF A PRIMER ON WELL WATER SAMPLING FOR VOLATILE ORGANIC SUBSTANCES,
Arizona Water Resources Research Center, Tucson.
P. W. Holden, L. G. Wilson, and J. M. Dworkin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-230043/AS, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, Arizona, Water Resources Research Center, Tucson, Sept 1984, 8 p, plus 44 p, append. USGS G828-24.

Descriptors: *Arizona, *Sampling, *Water wells, Pumps, Groundwater pollution, Volatile organic compounds.

A primer was written as a guide for establishing and implementing a program for sampling volatile organic compounds (VOC's) in drinking water wells. In addition to providing a simple review of the principles of ground-water movement and water well construction, the document summarizes the principal sources of VOC's in ground water and describes the importance of sampling water wells to detect the presence of health threatening chemicals. The document outlines approaches for developing a sampling protocol, including sampling frequency, sampling sites, preparation for field sampling, purging prior to sampling, sampling point location, sample collection, sample preservation and transportation, and documentation. Inasmuch as the results of the sampling effort may lead to litigation, chain of custody procedures are discussed together with methods for selecting an analytical laboratory. Finally, recommendations for interpreting and managing the data are outlined. The primer will be useful reference to public health agencies interested in establishing sampling programs and to field workers responsible for data collection. The primer is included as a separate appendix in the report.
W86-02612

MEASUREMENT OF DISCHARGE USING TRACERS,
Geological Survey, Reston, VA. Water Resources Div.
F. A. Kilpatrick, and E. D. Cobb.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Techniques of Water-Resources Investigations Book 3, Chapter A-16, 1984. 104 p, 28 fig, 6 tab, 19 ref.

Descriptors: *Discharge measurement, Dilution, *Tracers, *Dye releases, Fluorometry, Mixing, Background levels, Unsteady flow, Water sampling, *Dilution gaging, Dispersion, Constant injection, Slug injections, Measurements beneath ice, Measurements in pipes.

The development of fluorescent dyes and fluorometers which can measure these dyes at very low concentrations has made dye-dilution methods practical for measuring discharge. These methods are particularly useful for determining discharge under flow conditions which are unfavorable for making current-meter measurements. This manual describes the slug injection and constant-rate injection methods of performing tracer-dilution measurements. Emphasis is on the use of fluorescent dyes as tracers and the equipment, field methods, and laboratory procedures for performing such measurements. Measurements in streams, canals, pipes, and under ice are discussed. Tracer-velocity measurement of flow in pipes and other man-made structures having known geometries are also discussed. (USGS)
W86-02776

GROUND-WATER LEVELS IN OBSERVATION WELLS IN OKLAHOMA, 1982-83 CLIMATIC YEARS,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02784

INERTIAL INSTRUMENT SYSTEM FOR AERIAL SURVEYING,
Geological Survey, NSTL Station, MS. Water Resources Div.
R. H. Brown, C. E. Mongan, W. H. Chapman, W. F. Hanna, and J. W. Hursh.
Available from: OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-184, 1985. 196 p, 49 fig, 7 tab, 28 ref.

Descriptors: *Surveying instruments, Data collections, Terrain data, Topography, *Aerial profiling of terrain, *Aerial surveying, *Inertial navigation, *Laser profiler.

An inertial guidance system for aerial surveying has been developed under contract to the U.S. Geological Survey. This prototype system, known as the aerial profiling of terrain (APT) system, is designed to determine continuously the positions of points along an aircraft flight path, or the underlying terrain profile, to an accuracy of + or - 0.5 ft (15 cm) vertically and + or - 2 ft (61 cm) horizontally. The system's objective thus is to accomplish, from a fixed-wing aircraft, what would traditionally be accomplished from ground-based topographic surveys combined with aerial photography and photogrammetry. The two-part strategy for measuring the terrain profile entails: (1) use of an inertial navigator for continuous determination of the three-coordinate position of the aircraft, and (2) use of an eye-safe pulsed laser profiler for continuous measurement of the vertical distance from aircraft to land surface, so that the desired terrain profile can then be directly computed. The APT system, installed in a DeHavilland Twin Otter aircraft, is typically flown at a speed of 115 mph (105 knots) at an altitude of 2,000 ft (610 m) above the terrain. Performance-evaluation flights have shown that the vertical and horizontal accuracy specifications are met. (USGS)
W86-02790

GROUND-WATER LEVELS IN ARKANSAS, SPRING 1985,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02812

WATER RESOURCES DIVISION WATER LEVEL RECORDER RENTAL PROGRAM - HISTORY AND OPERATION,
Geological Survey, NSTL Station, MS. Water Resources Div.
S. R. Jeffers, and C. R. Wagner.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report OFR 84-735, 1984. 27 p, 4 fig, 3 tab.

Descriptors: *Instruments, *Equipment, *Water level recorder, Cost analysis, Optimization, Rent, Management planning.

The U.S. Geological Survey introduced a new water level recorder in the early 1960's to automate computation of streamflow records. At the same time it developed a rental program as a means of providing the recorders to field offices. This report documents the experience gained over the past 20 years and offers suggestions for operation of a rental program in the future, as we prepare to introduce a third generation of water level recorders. (USGS)
W86-02819

COMPILATION OF SELECTED HYDROLOGIC DATA FROM THE MX MISSILE-SITING INVESTIGATION, EAST-CENTRAL NEVADA AND WESTERN UTAH,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02903

7C. Evaluation, Processing and Publication

USE OF MICROCOMPUTERS TO AID WASTEWATER TREATMENT PLANT OPERATIONS,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-02444

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1983, VOLUME 4. NORTHERN CALIFORNIA VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02771

WATER RESOURCES DATA FOR CALIFORNIA, 1983, VOLUME 3. SOUTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM WALKER RIVER TO TRUCKEE RIVER,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02772

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02773

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NORTHEASTERN CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02774

WATER-DATA PROGRAM OF THE U.S. GEOLOGICAL SURVEY IN KANSAS, FISCAL YEAR 1983,
Geological Survey, Lawrence, KS. Water Resources Div.
R. K. Livingston, and K. D. Medina.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4306, 1984. 44 p, 11 fig, 4 tab, 22 ref.

Descriptors: *Data collections, Quality control, *Network design, Hydrologic data, Data program, *Kansas.

The U.S. Geological Survey is the principal Federal agency responsible for the collection of hydrologic data needed for the planning, development, use, and management of the water resources in Kansas. Hydrologic-data collection by the U.S. Geological Survey in Kansas began in 1895. The fiscal-year 1983 water-data program, operated in cooperation with several Federal, State, and local agencies, included 270 stations for collection of river, lake, and reservoir data, 1,940 wells for collection of ground-water data; 53 sampling stations and 215 wells for collection of water-quality data. This report provides a detailed description of the water-data program, including coordination and funding, data-collection activities, quality-assurance plans, availability of data, network design, and future needs for water data. (USGS)
W86-02778

COST EFFECTIVENESS OF THE U.S. GEOLOGICAL SURVEY'S STREAM-GAGING PROGRAM IN ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02782

GENERALIZED CONFIGURATION OF THE BASE OF THE HIGH PLAINS AQUIFER IN KANSAS,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02791

GENERALIZED POTENTIOMETRIC-SURFACE MAP OF THE HIGH PLAINS AQUIFER IN WYOMING, 1981,
Geological Survey, Cheyenne, WY. Water Resources Div.
C. Avery, and R. A. Pettijohn.
Available from: OFSS, USGS box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report (map) 84-4033, 1984. 1 pl. 1 fig, 11 ref.

Descriptors: *Groundwater, *Water level, Aquifers, Maps, *Wyoming, *High Plains aquifer, *Potentiometric contours.

A potentiometric-surface map shows the general configuration of the water surface for the High Plains Aquifer, which is composed of Oligocene age and younger rocks in southeastern Wyoming. The potentiometric contours are shown at 100-foot intervals on a map at a scale of 1:250,000. The High Plains Aquifer in Wyoming underlies an area of 8,190 square miles and geologically consists of the White River Formation of Oligocene age, the Arikaree Formation of early Miocene age, the Ogallala Formation of late Miocene age, and alluvial deposits of Quaternary age. The altitude of the potentiometric surface declines from about 7,100 feet in southwestern Laramie County to about 4,100 feet in eastern Goshen County. Typically, the slope is between 20 and 30 feet per mile; the general direction of flow is eastward. (USGS)
W86-02795

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02799

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, OREGON,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02800

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND PROVINCE, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02801

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02802

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, ARIZONA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02803

MAP SHOWING OUTCROPS OF GRANITIC ROCKS AND SILICIC SHALLOW-INTRUSIVE ROCKS, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W86-02805

MAP SHOWING OUTCROPS OF ASH-FLOW TUFFS, BASIN RANGE PROVINCE AND VICINITY, TRANS-PECOS TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W86-02806

U.S. GEOLOGICAL SURVEY URBAN-STORMWATER DATA BASE FOR 22 METROPOLITAN AREAS THROUGHOUT THE UNITED STATES,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02808

HYDROLOGIC DATA FOR AQUIFERS IN PHILADELPHIA, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
G. N. Paulachok, C. R. Wood, and L. J. Norton.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 83-149, 1984. 104 p, 5 fig, 7 tab, 8 ref.

Descriptors: *Hydrologic data, *Well data, Water quality, Water level fluctuations, *Data collections, *Aquifers, *Philadelphia, *Pennsylvania, Geophysical Log Index.

Selected data on the ground-water resources of Philadelphia, Pennsylvania are presented in this report. Information including water levels and data for aquifers is tabulated for 828 wells and 3 sumps. Chemical analyses are given for 1,469 water samples obtained from 207 sites, including 105 analysis for trace elements and 70 analyses for volatile organic compounds. An index of geophysical logs including gamma ray, neutron, caliper, fluid conductivity, fluid velocity, single-podint resistance, spontaneous potential, and temperature determinations made in 51 wells is also presented. Data-collection points are shown on a 1:50,000 scale location map. (USGS)
W86-02815

PARTIAL COMPILATION AND REVISION OF BASIC DATA IN THE WATEQ PROGRAMS,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02816

WATER-RESOURCES REPORTS PREPARED BY OR IN COOPERATION WITH THE U.S. GEOLOGICAL SURVEY, KANSAS, 1886-1983,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 10C.
W86-02818

SEDIMENT DATA FOR GEORGIA STREAMS, WATER YEARS 1958-82,
Geological Survey, Doraville, GA. Water Resources Div.
H. A. Perlman.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-722, 1985. 101 p, 1 fig, 4 tab, 10 ref.

Descriptors: *Sediment data, *Sediment concentration, *Bed sediment, *Particle size, Sediment transport, Stream discharge, *Data collection, *Georgia.

Sediment data have been collected regularly in Georgia by the U.S. Geological Survey since 1957. The data were collected in cooperation with a number of State and Federal agencies. The frequency of data collection varied and several sampling methodologies were used. This report presents suspended-sediment-concentration data for 179 sites, suspended-sediment particle-size for 16 sites, and bed-material particle-size data for 19 sites collected from October 1957 to September 1982. (USGS)
W86-02821

GENERALIZED POTENTIOMETRIC SURFACE OF AQUIFERS OF PLEISTOCENE AGE, SOUTHERN LOUISIANA, 1980,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. Martin, and C. D. Whiteman.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4331, 1985. 1 sheet (map), 1 fig, 1 tab, 12 ref.

Descriptors: *Water levels, Aquifers, *Aquifer systems, *Water table, *Artesian aquifers, *Louisiana, Pleistocene age, Tertiary age, *West Gulf Coastal Plain, *RASA, *Maps.

A map of potentiometric surface defines generalized water levels for 1980 in the Pleistocene

aquifers of southern Louisiana. The map was prepared as part of the Western Gulf Coast Regional Aquifer-System Analysis study. The Pleistocene deposits in southern Louisiana consist of alternating beds of sand, gravel, silt, and clay deposited under fluvial, deltaic, and near-short marine conditions. The aquifers are mainly under artesian conditions and the regional flow direction is primarily southward. Areally definable cones of depression result from heavy pumpage in the Baton Rouge, Lake Charles, and New Orleans metropolitan areas and in the rice irrigation area of southwestern Louisiana. Where water levels differ vertically within the aquifer, the lowest water levels in the vertical section were used because these levels represented the thickest and most heavily pumped unit in the aquifer. The map represents regional water levels in the Pleistocene aquifers, and is not intended to show localized variations near pumping centers. (USGS)
W86-02835

APPRAISAL OF THE WATER RESOURCES OF THE EASTERN PART OF THE TULARE AQUIFER, BEADLE, HAND, AND SPINK COUNTIES, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02836

SELECTED CLIMATOLOGICAL AND HYDROLOGIC DATA, RATON BASIN, HUERFANO AND LAS ANIMAS COUNTIES, COLORADO, AND COLFAX COUNTY, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02839

GROUND WATER IN UTAH'S RAPIDLY GROWING WASATCH FRONT AREA--THE CHALLENGE AND THE CHOICES,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02843

GROUND-WATER RESOURCES OF NORTHERN UTAH VALLEY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02844

GROUND WATER HYDROLOGY OF THE ELIZABETHTOWN AREA, KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02845

REGIONAL AQUIFER-SYSTEM ANALYSIS OF THE HIGH PLAINS AQUIFER IN PARTS OF COLORADO, KANSAS, NEBRASKA, NEW MEXICO, OKLAHOMA, SOUTH DAKOTA, TEXAS, AND WYOMING--GEOHYDROLOGY,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02850

PERCENTAGE CHANGE IN SATURATED THICKNESS OF THE HIGH PLAINS AQUIFER, WEST-CENTRAL KANSAS, 1950 TO AVERAGE 1982-84,
Geological Survey, Garden City, KS. Water Resources Div.
M. E. Pabst, and B. J. Dague.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4357, 1984. 1 p (map), 1 fig, 11 ref.

Descriptors: *Approximation method, *Hydrologic data, Maps, *Hydrologic maps, *Water levels, Water yield, Aquifers, Kriging, *Kansas.

Water-level altitudes at the center of each 1-square-mile section (1,859 values) in Western Kansas Groundwater Management District No. 1 were interpolated from 292 measured water levels using a statistical technique referred to as kriging. The kriging technique involves the use of a series of computer programs that convert selected geohydrologic data into map form. A map that illustrates the percentage change in saturated thickness of the High Plains aquifer from 1950 to average 1982-84 in west-central Kansas was constructed by comparing kriged water-table altitudes (based on average 1982-84 data) with estimated 1950 water-table altitudes and bedrock-surface altitudes. (USGS)
W86-02855

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN KANSAS--FISCAL YEARS 1983 AND 1984,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02865

STATISTICAL SUMMARY OF DAILY VALUES DATA AND TREND ANALYSIS OF DISSOLVED-OXYGEN DATA AT NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN) STATIONS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-02873

INTERPOLATING WATER-TABLE ALTITUDES IN WEST-CENTRAL KANSAS USING KRIGING TECHNIQUES,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02880

SUMMARY OF WATER RESOURCES DEVELOPMENT AND HYDROLOGIC DATA OF SAIPAN, MARIANA ISLANDS,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02887

MAPS SHOWING GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
B. T. Brady, M. S. Bedinger, and D. L. Hart.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4118-A, 1984. 6 p, 1 pl, 3 fig, 36 ref.

Descriptors: Groundwater, *Groundwater movement, Selected withdrawal, Hydrogeology, Water use, *Basin and Range province, *New Mexico, *Maps.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps describing selected hydrologic information of the New Mexico part of the Basin and Range province. The first map, at a scale of 1:500,000, divides the area into ground-water units, which approximate ground-water drainage. In addition to ground-water units, the map shows consolidated-rock areas, basin fill, generalized ground-water flow directions, and man-induced and natural-discharge areas. A second map at a scale of 1:1,000,000 shows areas and quantity of groundwater withdrawal. (USGS)
W86-02889

MAPS SHOWING GROUND-WATER UNITS AND NUMBER OF LARGE-CAPACITY WELLS, BASIN AND RANGE PROVINCE, OREGON,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Reed, M. S. Bedinger, J. B. Gonthier, and W. D. McFarland.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4120-A, 1984. 4 p, 3 fig, 1 pl, 15 ref.

Descriptors: *Groundwater, Groundwater movement, Groundwater data, *Maps, Selected withdrawal, *Basin and Range province, *Oregon.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps describing hydrologic properties of the Oregon part of the Basin and Range province. The first map, at a scale of 1:500,000, divides the area into ground-water units, which approximate ground-water drainage. In addition to ground-water units, the map shows consolidated-rock areas, basin fill, generalized ground-water flow directions, and natural-discharge areas. A second map at a scale of 1:1,000,000 shows quantity of ground-water withdrawal. (USGS)
W86-02890

MAPS SHOWING GROUND-WATER LEVELS, SPRINGS, AND DEPTH TO GROUND WATER, BASIN AND RANGE PROVINCE, OREGON,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Reed, M. S. Bedinger, J. B. Gonthier, W. H. Langer, and W. D. McFarland.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4120-B, 1984. 5 p, 3 fig, 1 pl, 15 ref.

Descriptors: *Groundwater levels, Springs, *Maps, Groundwater data, *Basin and Range province, *Oregon.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps describing hydrologic properties of the Oregon part of the Basin and Range province. The first map, at a scale of 1:500,000 shows the approximate altitude of the water table, and the location, temperature, and flow of large springs. The altitude of the water table is shown by contours where sufficient data exists; otherwise it is shown by data points. Springs with flows of 10 gallons per minute or more have been mapped. A second map at a scale of 1:1,000,000 shows the depth to ground water and areas of basin fill or consolidated rocks. In areas where the depth to water is less than 500 feet, the depth is shown by lines of equal depth to water or data points where data are insufficient to draw lines. Areas where the depth to the water table is generally greater than 500 feet are shown as shaded areas. (USGS)
W86-02891

MAPS SHOWING OUTCROPS OF BASALTIC ROCKS OF EARLY QUARTERNARY AND TERTIARY AGES, BASIN AND RANGE PROVINCE, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
K. Roggensack, and K. A. Sargent.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4119-F, 1984. 20 p, 3 fig, 113 ref.

Descriptors: *Basaltic rocks, Aquifers, Geology, Hydrogeology, *Basin and Range province, *Nevada, *Maps.

Outcrops of basaltic rocks in Nevada have been delineated as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The sources of data, lithologic character, thickness, and distribution of basaltic units, ranging in age from early Quarternary to Tertiary, are described. (USGS)
W86-02892

HYDROGEOLOGY OF THE CLIFTON PARK AREA, SARATOGA COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. J. Reynolds.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4031, 1985. 6 pl, 6 fig, 15 ref.

Descriptors: *Hydrogeology, Confined aquifers, Unconfined aquifers, Glacial aquifers, Glacial drift, Land use, *Maps, Groundwater data, Colonie Channel aquifer, Clifton Park, Saratoga County, *New York, Land use, Soil permeability, Surficial geology, Bedrock topography, Saturated thickness.

The hydrogeology of the 75-square mile Clifton Park suburban area near Albany, N.Y., is presented in six maps at 1:24,000 scale. The maps show: (1) location of wells and test holes; (2) bedrock topography; (3) surficial geology and geologic sections; (4) saturated thickness of the confined aquifer; (5) generalized soil permeability; and (6) land use. The aquifers in the Clifton Park area serve approximately 22,000 people through 32 public distribution systems. Average daily pumpage from these systems is approximately 1.85 million gallons per day. The most productive aquifer is the Colonie Channel aquifer, a confined, buried bedrock channel aquifer of glacial material from which wells may yield more than 500 gallons per minute. A water-table aquifer of fine sand is present over most of the area and is separated from the confined aquifer by a thick sequence of lacustrine silt and clay. Recharge to the confined aquifer occurs primarily where kame-delta deposits that are exposed at land surface are hydraulically connected to the buried aquifer. Saturated thickness of the confined aquifer varies from less than 5 feet to approximately 70 feet. In recharge areas, where the aquifer is locally under water-table conditions, saturated thickness may exceed 100 feet. Pumping interference between wells tapping the confined aquifer has been observed over distances of 3/4 mile. (USGS)
W86-02894

PRELIMINARY REPORT ON A STUDY TO ESTIMATE FLOOD VOLUMES OF SMALL RURAL STREAMS IN OHIO: METHODS, SITE SELECTION, AND DATA BASE,
Geological Survey, Columbus, OH. Water Resources Div.
J. M. Sherwood.
Available from OFSS, USGS Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-470, 1985. 138 p, 2 fig, 7 tab, 8 ref.

Descriptors: *Flood data, *Small watersheds, Agricultural watersheds, Data collections, Runoff, Storm runoff, *Flood volumes, *Ohio.

In April 1981, the U.S. Geological Survey, in cooperation with the Ohio Department of Transportation and the Federal Highway Administration, initiated a 7-year flood-volume study of small (less than 10 square miles) rural basins in Ohio, 32 of which were selected for detailed analysis. The report summarizes the methods of study and describes reconnaissance and site selection procedures, locations and characteristics of the stations, instrumentation, and methods of collecting and storing data. Five years of 5-minute rainfall-runoff data were collected to calibrate and verify a rainfall-runoff model for each basin. The calibrated model is used in conjunction with 80 years of National Weather Service 5-minute precipitation data to synthesize a representative 80-year streamflow record at each site. A Log-Pearson Type III frequency distribution defines the magnitudes and frequencies of flood volumes at each site. The report also summarizes rainfall-runoff data collected from July 1981 through September 1983 but does not interpret the data. (USGS)
W86-02906

PENNSYLVANIA GAZETTEER OF STREAMS - PART II,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02907

STATE HYDROLOGIC UNITS MAPS,
Geological Survey, Reston, VA. Water Resources Div.
P. R. Seaber, F. P. Kapinos, and G. L. Knapp.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-708, 1984, 22 p, 5 fig, 1 pl, 21 tab, 28 ref.

Descriptors: *Maps, *Mapping, *Hydrology, *Drainage basins, United States, *Hydrologic Unit Maps.

A set of maps depicting approved boundaries of, and numerical codes for, river-basin units of the United States has been developed by the U.S. Geological Survey. These 'State Hydrologic Unit Maps' are four-color maps that present information on drainage, culture, hydrography, and hydrologic boundaries and codes: (1) the 21 major water-resources regions and the 222 subregions designated by the U.S. Water Resources Council; (2) the 352 accounting units of the U.S. Geological Survey's National Water Data Network; and (3) the 2,149 cataloging units of the U.S. Geological Survey's Catalog of Information on Water Data. The maps are plotted on the Geological Survey State base-map series at a scale of 1:500,000 and, except for Alaska, depict hydrologic unit boundaries for all drainage basins greater than 700 mi squared (1,813 km squared). A complete list of all the hydrologic units, along with their drainage areas, their names, and the names of the States or outlying areas in which they reside, is contained in the report. These maps and associated codes provide a standardized base for use by water-resources organizations in locating, storing, retrieving, and exchanging hydrologic data. The Hydrologic Unit Codes shown on the maps have been approved as a Federal Information Processing Standard for use by the Federal establishment. (USGS)
W86-02908

STREAMFLOW AND SEDIMENT DATA COLLECTED AT SEVEN STREAM-GAGING STATIONS IN THE JAMES RIVER BASIN DOWNSTREAM FROM FORESTBURG, SOUTH DAKOTA, FROM OCT 1, 1982 - SEP 30, 1983,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02912

ALTITUDE AND CONFIGURATION OF THE WATER TABLE IN THE HIGH PLAINS AQUIFER IN KANSAS, 1980,
Geological Survey, Garden City, KS. Water Resources Div.
M. E. Pabst, and L. E. Stullken.
Available from: OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4009, 1985. 1 p, 3 fig, 5 ref.

Descriptors: *Water table, *Potentiometric level, Groundwater, Unconfined aquifers, Underflow, Underground storage, Water-bearing formations, *Kansas, *High Plains.

The High Plains aquifer in Kansas is a part of a regional system that extends from South Dakota to Texas. The aquifer in Kansas underlies an area of 31,000 square miles in the western and south-central part of the State. This aquifer is a hydraulically connected assemblage of unconsolidated water-bearing deposits of Tertiary and Quaternary age. Maps published at a scale of 1:500,000 show the altitude and configuration of the water table in Kansas during 1980. Ground water moves from higher altitudes in the western part of the high Plains to lower altitudes in the eastern part at an average rate of 10 feet per mile. The up-gradient flexure of water-table contours along some of the valleys indicates that ground water discharges to the streams in those areas. (USGS)
W86-02919

8. ENGINEERING WORKS

8A. Structures

STREAMBANK EROSION PROTECTION AND CHANNEL SCOUR MANIPULATION USING ROCKFILL DIKES AND GABIONS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
P. C. Klingeman, S. M. Kehe, and Y. A. Owusu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-246718/AS, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Research Institute Publication WRRI-98, Corvallis, September 1984. 169 p, 48 fig, 18 tab, 57 ref, append. USGS G864-09. 14-08-0001-G-864.

Descriptors: *Bank erosion, Channel erosion, Stream erosion, *Erosion control, *Bank protection, *Bank stabilization, *Stream stabilization, Scour, *Channel scour, Dikes, Spur dikes, Gabions, Riprap, Aquatic habitats, Stream fisheries, Stream improvement, Stream stabilization, Model studies, *Hydraulic models, *Willamette River, *Oregon.

Uses of rockfill spur dikes and of gabion groins and gabion weirs for streambank erosion protection and streambed scour control were examined through literature review, laboratory model studies and field investigations. The summarized literature review includes general design features and recommended structure orientation angles and spacing/length ratios. Model studies of streamflow patterns and bed scour patterns for various structure arrangements allowed evaluation of best configurations for protecting eroding banks and manipulating the scour patterns. Influences were evaluated due to dike/groin length, orientation angle and spacing. Typical protection was for two to five times the structure length. Upstream-oriented structures were more effective than perpendicular or downsteam-oriented structures in deflecting the current away from the bank and in causing extensive scour holes. V-shaped weirs pointing upstream caused large scour holes in mid-channel, with angles of 90-120 degrees giving the maximum scour depth and volume. V-shaped weirs pointing downstream caused holes near each bank. Field studies allowed comparison with laboratory results and with results of other researchers. Local scour and bed and bank adjustments to a groin on a small creek and to a new spur dike field on the Willamette River were documented, as were flow patterns, velocities and depths in the dike field.
W86-02665

8B. Hydraulics

LOW FLOW HYDRAULICS IN ALLUVIAL CHANNELS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. A. Miller, and H. G. Wenzel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249274/AS, Price codes: A04 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana-Champaign, Research Report No 192, September 1984. 51 p, 14 fig, 6 tab, 19 ref. USGS G840-06. 14-08-0001-G840.

Descriptors: Pools, Riffles, *Low flow, Open-channel flow, River flow, Steady flow, Streamflow, Surface flow, Nonuniform flow, Varied flow, *Alluvial channels, Alluvial rivers, Hydraulic models, Computer models, *Mathematical models.

The investigation of the low flow condition has become important in recent years as a means of determining critical levels of water pollution, aquatic habitat and instream flow needs. To assess these critical conditions, it is necessary to predict the hydraulic response of a river system to a given low flow discharge. Conventional flow models, however, are often inaccurate at low discharges

due to the geometric and hydraulic channel features peculiar to these flow conditions. The dominant channel feature at low stages is the pool-riffle sequence, where pools are distinguished by deep, slow moving water and riffles by shallow, relatively rapid moving flow. Conventional flow models have difficulty effectively representing the highly nonprismatic channel geometry, the rapidly changing flow hydraulics, and the dominating influence of flow resistance characteristic of pool-riffle sequences. In this research, a one-dimensional mathematical model has been developed to simulate accurately channel characteristics under low flow conditions. For a given steady discharge, channel geometry, and channel bed particle size distribution, the model predicts the flow depth, the mean velocity, and the flow resistance. Energy losses generated by the contractions and expansions occurring through the pool-riffle sequence. The model has been verified using field data, as well as laboratory data collected in conjunction with the project.
W86-02698

DIFFUSION AND ADVECTION IN TWO-DIMENSIONAL ROTATING FLOW,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W86-02699

8E. Rock Mechanics and Geology

HYDRAULIC CONDUCTIVITY OF ROCKFILL: VOLUME I,
New Orleans Univ., LA. Dept. of Civil Engineering.
A. A. Hannoura, and K. L. McManis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-219087/AS, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, July 1983. 63 p, 8 fig, 136 ref. OWRT B-012-LA(1). 14-34-0001-9150.

Descriptors: Hydraulic conductivity, Friction equation, *Rock fill, Rubble mounds, *Rockfill dams, Flow characteristics, Porous media, Friction.

This final report is published in two volumes. The first volume includes the state-of-the-art, and the second is based on the test results of this project. An extensive survey was made of previous research findings on the subject of the hydraulic conductivity of coarse granular media which is the common construction material for rockfill dams; rubble-mound structures; and filter type structures. Experimental procedures and results of permeability tests of four crushed rock sizes ranging from 0.95 cm to 15.24 cm., and five rounded gravel sizes ranging from 1.27 cm to 25.4 cm. are given. Flow regimes are identified and dimensionless equations are developed for each regime. A generalized equation covering a wise flow range, i.e., low to high Reynolds number is developed. Surface roughness, wall effect, shape factor, angularity, porosity function, and grain size distribution are considered.
W86-02555

HYDRAULIC CONDUCTIVITY OF ROCKFILL: VOLUME II,
Louisiana Water Resources Research Inst., Baton Rouge.
A. A. Hannoura, and K. L. McManis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-219095/AS, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, August 1983. 67 p, 17 fig, 18 ref, 1 append. OWRT B-012-LA(1). 14-34-0001-9150.

Descriptors: *Hydraulic conductivity, Friction equation, Rock fill, Rubble mounds, Porous media, Hydraulics, Flow characteristics, Friction, *Rockfill dams.

An extensive survey was made of previous research findings on the subject of the hydraulic conductivity of course granular media which is the common construction material for rockfill dams, rubble-mound structures, and filter type structures. Experimental procedures and results of permeability tests of four (4) crushed rock sizes ranging from 0.95 cm to 15.24 cm are given in the second volume. Flow regimes are identified and dimensionless equations are developed for each regime. A generalized equation covering a wide flow range, i.e., low to high Reynolds number is developed. Surface roughness, wall effect, shape factor, angularity, porosity function, and grain size distribution are considered.
W86-02556

MAP SHOWING OUTCROPS OF GRANITIC ROCKS AND SILICIC SHALLOW-INTRUSIVE ROCKS, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
F. A. Hills.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4116-D, 1984. 38 p, 2 fig, 174 ref.

Descriptors: *Granitic rocks, *Silicic shallow-intrusive rocks, Geology, Hydrogeology, *Basin and Range Province, *California, *Maps.

Outcrops of granitic rocks and silicic shallow-intrusive rocks have been delineated in southern California as part of a study by the U.S. Geological Survey of the Basin and Range Province of the western United States. The lithologic character, geologic age, distribution, and sources of data of the geologic units are described. (USGS)
W86-02805

MAP SHOWING OUTCROPS OF ASH-FLOW TUFFS, BASIN RANGE PROVINCE AND VICINITY, TRANS-PECOS TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
C. D. Henry, and G. L. Fisher.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4121-E, 1984. 8 p, 6 fig, 38 ref.

Descriptors: *Ash-flow tuffs, *Geology, Hydrogeology, *Basin and Range Province, *Trans-Pecos Texas, *Texas, *Maps.

Outcrops of ash-flow tuffs have been delineated in Trans-Pecos Texas as part of a study by the U.S. Geological Survey of the Basin and Range Province of the western United States to evaluate potentially suitable areas for future study for isolation of high-level radioactive waste. In this map report the name, location, isotopic age, caldera source, volume, lithologic character and reference sources for each ash-fall unit is described. (USGS)
W86-02806

8G. Materials

PASSIVE FILMS ON IRON: THE MECHANISM OF BREAKDOWN IN CHLORIDE-CONTAINING SOLUTIONS,
Texas A and M Univ., College Station. Dept. of Chemistry.
T. E. Pou, J. Carbajal, G. L. Campbell, and P. Nilson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211670/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Report: A Research Program on Alloys for Marine Environments. March 1983. 46 p, 12 fig, 4 tab, 52 ref. C-90274-S(1). 14-34-0001-9446.

Descriptors: *Corrosion, *Metals, *Iron, *Films, *Marine environment, *Seawater, Alloys, Passive films, Chlorides, Texas.

Electrochemical and spectroscopic techniques were applied to the problems of distribution of hydrogen or water within passive films and the distribution of chloride ions in the bulk of passive films after exposure to chloride-containing films. Criteria derived from electrochemically derived kinetic data was sharply inconsistent with several models for passive film breakdown: adsorption-displacement, pore or flaw, and chemico-mechanical. It is not inconsistent with the following: ion exchange processes, point defect models, and hydrated polymetic oxide models. Spectroscopic data pointed to a dehydrated structure. It was also concluded that the thickness of passive films remains unchanged for various times of exposure to chloride ions before and after breakdown.
W86-02438

8I. Fisheries Engineering

FURTHER INVESTIGATIONS OF GOLDFISH IN EASTERN WASHINGTON LAKES AND EVALUATION OF ELECTROFISHING AS A TOOL FOR CONDUCTING REMOVAL OPERATIONS,
Eastern Washington Univ., Cheney. Dept. of Biology.
For primary bibliographic entry see Field 5G.
W86-02511

CONTROL OF ALGAL DOMINANCE THROUGH CHANGES IN ZOOPLANKTON GRAZING, LAKE WASHINGTON: PHASE II,
Washington Univ., Seattle. School of Fisheries.
For primary bibliographic entry see Field 6G.
W86-02514

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

FINAL PROGRAM REPORT FOR THE FY1983 NEVADA WATER RESEARCH INSTITUTE PROGRAM,
Nevada Univ. System, Reno. Water Resources Center.
For primary bibliographic entry see Field 9D.
W86-02622

FISCAL YEAR 1984 PROGRAM REPORT (NEVADA WATER RESOURCES CENTER).
Nevada Univ. System, Reno. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132321/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-919-01, September 1985, 23 p. USGS G919-01. 14-08-0001-G919.

Descriptors: *Research, *Information transfer, *Training, *Nevada, Artificial recharge, Groundwater management, Budgetary, Water demand, Hazards, Mass wasting, Salinity, Lake shores, Water conservation, Water harvesting.

The Nevada research program for FY 1984, funded in part by the U.S. Department of the Interior as authorized by the Water Resources Research Act of 1984 (P.L. 98-242), is described. Five research projects were undertaken, namely: Water Harvest and Artificial Recharge--This research is directly related to (a) water conservation; (b) conjunctive use of surface waters and groundwaters; and (c) legal/institutional aspects of allocation of new and newly quantified water supplies and reallocation of existing supplies in Golden Valley, Nevada. An Applications of Risk and Uncertainty in Rural Water Systems in Nevada--This project examined the allocation of financial resources for improvement and expansion of water supply systems in rural areas of Nevada. Identification and Assessment of Water-Related Hazard Zones of the Eastern Sierra Nevada--This project deals with the use of remote sensing techniques for identification of water related hazard zones. This has direct application for such problems as mass wasting and flooding which are being recognized

as serious problems in the Arid West. Contribution of Salt Bearing Formations to Salinity Concentrations in Lake Mead--A study to evaluate the effects of salt bearing shoreline formations on the salt load of Lake Mead and the lower Carson River Basin. Rainfall Runoff Harvesting in the Carson Desert--The water harvesting technique investigated may provide an efficient method for use of water which is currently being evapotranspired, providing an additional source of water supply in regions of critically low rainfall.
W86-02732

9D. Grants, Contracts, and Research Act Allotments

1983 INSTITUTE PROGRAM REPORT, (ARKANSAS WATER RESOURCES RESEARCH CENTER),
Arkansas Water Resources Research Center, Fayetteville.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-211712/AS, Price codes: A05 in paper copy, A01 in microfiche. Annual program report, Sept 1983. 81 p. USGS G829-01.

Descriptors: *Arkansas, *Water Resources Institute, *Research priorities, Water quality, Water use, Water law, Economic evaluation, Agriculture, Data interpretation, Institutions, Information exchange.

Summarization of water programs includes discussion of key water related problems for Arkansas, prime research and development priorities, including water quality, water quantity, water use, agriculture, institutional, water economics, water law, water data gases. Regional research priorities, examples of effective research and development results, and information dissemination activities are also described.
W86-02442

FISCAL YEAR 1983 INSTITUTE PROGRAM REPORT (VERMONT WATER RESOURCES RESEARCH CENTER),
Vermont Water Resources Research Center, Burlington.
L. L. Arris, and E. A. Cassell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214500/AS, Price codes: A04 in paper copy, A01 in microfiche. Program report, Burlington, December, 1984. 47 p. USGS G873-01.

Descriptors: *Water resources institutes, Research priorities, *Vermont.

Using the Center's Five-Year Plan for Water Research as a guide, investigators studied water management problems of the highest priority in Vermont, including: Water Quality/Watershed Management, Lake Processes, Groundwater, Acid Precipitation, Water Resources Data Management, and Allocation of Water Resources. The Water Center supported five major water research/information dissemination projects during the year. For the second year the Vermont Water Center has supported research dealing with acid precipitation. Also the Center carried out in-service training of state-of-the-art data management systems for water and natural resource professionals. The funded research projects included: (1) Streptococci as Indicators of Source and Type of Surface Water Contamination (G873-03); (2) Acid Precipitation: Compositional Changes During Throughfall (G873-04); (3) Characterization of Aluminum Chemistry in Acid Precipitation (G873-05); (4) Temporal and Spatial Variability of Streamflow in Vermont (G873-02); (5) Measurements of Low Flows in Shallow Bodies of Water (G873-06).
W86-02454

FY 1983, NORTH CAROLINA WATER RESOURCES RESEARCH INSTITUTE, FINAL PROGRAM REPORT.
North Carolina Water Resources Research Inst., Raleigh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214591/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Program Report (1984). 28 p. USGS G860-01.

Descriptors: *Water resources research, *Groundwater quality, Hydrilla, Eutrophication.

A report has been prepared describing the program of the Water Resources Research Institute of The University of North Carolina. The Institute, in cooperation with the U.S. Department of Interior, supported research, graduate training, and technology transfer programs in response to major water problems of concern to the state and federal water agencies. Progress reports are included for three continuing research projects: (1) Arresting Eutrophication in Rivers, (2) Environmental Control of Phytoplankton in a Piedmont Reservoir, and (3) Pollutant Removal Effectiveness and the Hydraulics of Wetland Filter Areas for Pumped Agricultural Drainage Water. Final completion reports and synopses are provided for three projects: (1) Integrated Management of the Aquatic Weed Hydrilla, (2) Effects of Peatland Drainage on Mercury Dynamics in Coastal Plain, and (3) Evaluation of Vegetative Filter for Dairy Waste Treatment in Southern Appalachia. All senior colleges and universities in North Carolina are eligible to participate in the Institute program. In addition to Department of Interior financial support, the Institute received support from eight other sources. A program of technology transfer supported primarily from state funds is described. These efforts include workshops, research review meetings, newsletters, and an extensive public service role by both the Institute Director and Associate Director.
W86-02463

(MICHIGAN) INSTITUTE OF WATER RESEARCH FY 1983, PROGRAM REPORT.
Michigan State Univ., East Lansing. Inst. of Water Research.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214617/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Program Report, Michigan Institute of Water Research, East Lansing, (1984). 30 p, 3 fig. USGS G849-01.

Descriptors: *Michigan, *Water resources research, *Toxic wastes, *Groundwater quality, Nonpoint sources, Urban hydrology, Atmospheric deposition, Lakes, Eutrophication.

The research projects in the Institute of Water Research's 1983 program were selected to address those research priorities which constitute major problems not only with respect to Michigan's water resources, but also that reflect regional and national water resources concerns. Michigan demonstrates a multitude of water quality management and pollution problems. Clearly, they cannot all be attacked at once. Therefore, research priorities were identified in the Institute of Water Research Five-Year Water Research and Development Plan, and the 1983 Institute of Water Research program focused its research and information dissemination and retrieval efforts in the following major areas: (1) Definition of the mechanisms affecting the fate, transport, and effect of toxic and hazardous materials which enter the water and groundwater as waste products or pollutants; (2) Investigation of physical, chemical, and biological variables controlling groundwater quality and quantity; (3) Investigation of mechanisms influencing non-point source pollutants including urban and agricultural land runoff, residual waste disposal, on-site sewage disposal systems, atmospheric deposition of waste products, and water conservation through irrigation scheduling; (4) Identification of control mechanisms affecting lake eutrophication and development of management strategies to minimize the impact on inland lakes and the Great Lakes.
W86-02465

FISCAL YEAR 1983 PROGRAM REPORT (ALASKA INSTITUTE OF WATER RESOURCES).
Alaska Univ., Fairbanks. Inst. of Water Resources.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214690/AS, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 184-08, September, 1984. 18 p. USGS G827-01.

Descriptors: *Alaska, Arsenic, Water treatment, Flocculants, Law, *Legal aspects, *Planning, Turbidity, Water chemistry, Oxygen content, *Fisheries.

The report contains synopses of the completion reports for three projects. A fourth, on the geochemistry of saline lakes, was delayed by equipment problems but has been completed most successfully. It will provide valuable insights into geochemistry and will be forwarded soon under separate cover. Funding arrived so late that the project on snowmelt infiltration could not begin in the anticipated field season, and so had to be delayed a year. The report should be forwarded in about 60 days. The report on microcomputer software will also be forthcoming in the near future. Each project contributes important new information or capabilities to problems facing the northern community. Several have broad implications that transcend geographic areas.
W86-02472

REPORT OF THE UNIVERSITY OF KENTUCKY WATER RESOURCES RESEARCH INSTITUTE FOR FISCAL YEAR 1983,
Kentucky Water Resources Research Inst., Lexington.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214757/AS, Price codes: A02 in paper copy, A01 in microfiche. September, 1983. 20 p. USGS G-844-01.

Descriptors: Research, Technology transfer, *Kentucky, *Water pollution effects, *Coal mining effects, Toxic wastes.

The report of the University of Kentucky Water Resources Research Institute for fiscal year 1983 consists of a synopses of all research reports and Institute technology transfer projects funded with the grant G-844. Each synopses includes a statement of the project's purpose, a brief explanation of methods and procedures, principal findings, a conclusion and a list of publications produced. The project synposes included are: G-844-02, Toxicity, Leachability, and Environmental Transport of Aquatic Pollutants Originating from Coal Production and Utilization; G-844-03, Finite Element Analysis of Coupled Flow and Contaminant Transport in Saturated-Unsaturated Porous Media; G-844-04, Identification of Soil-Water Chemical Parameters for the Prediction and Treatment of Suspended Solids in Surface Water Reservoirs of Coal Mine Lands; G-844-05, A Membrane-Organic Phase Oxidation Process for the Destruction of Toxic Organics in Hazardous Waste-Waters; G-844-06, Impact Assessment of Coal Slurry Pipelines on Water Resources Utilization and Allocation; G-844-07, Determination of Conveyance and Other Parameters of the Inner Bluegrass Karst Aquifer; G-844-23, Guidelines for Wetland Practice in Coal Mine Areas; and G-844-22; Fiscal Year 1983 Technology Transfer Activities. A Cooperative Agreement with the University of Louisville is included.
W86-02478

RESEARCH IN ACTION: SOLVING COLORADO WATER PROBLEMS, FY 1983 ANNUAL REPORT,
Colorado Water Resources Research Inst., Fort Collins.
A. Evans, and W. L. Raley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214781/AS, Price codes: A05 in paper copy, A01 in microfiche. Annual Report No. 28, September, 1984. 40 p, 17 append. USGS G831-01.

Descriptors: *Research and development, *Water resources development, Programs, Administration, *Technology transfer, *Colorado.

The Colorado Water Resources Research Institute conducted a single research project in FY 1983 to integrate results of prior research on water management problems of the South Platte Basin. The results and products of this program will be transferable throughout the State and throughout the region. The principal objective of the project was to identify options for best development and management of the South Platte Basin's limited water supply. Emphasis was placed on potential for use of computer technologies. Team investigators considered urban and industrial water conservation, stream-aquifer modeling, water storage optimization, Denver Basin deep-bedrock groundwater, the quality of surface and groundwaters, economics of water allocation alternatives, legal-institutional aspects of water allocation, and current management practices. The Institute's technology transfer program was fully integrated with its water research and development program. Water user workshops and seminars were conducted while the research project was in progress. A monthly Colorado Water Issues Forum was held in Denver, and authoritative speakers presented programs of current interest to water managers, professionals, and interested citizens. The Institute's technology transfer program also includes: newsletters; three publications series; distribution of a 'Library List' of new water resources research reports and publications; Project AWARE, designed to keep State and Federal agency personnel aware of proposed research; public water policy education (programs, including slide presentations); and workshops, seminars, and small group consultations involving potential users.
W86-02481

RHODE ISLAND WATER RESOURCES CENTER, ANNUAL PROGRAM REPORT, FISCAL YEAR 1983,
Rhode Island Water Resources Center, Kingston.
C. P. C. Poon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214872/AS, Price codes: A04 in paper copy, A01 in microfiche. FY-1983 Annual Program Report, Sept 1984. 44 p. USGS G867-01.

Descriptors: *Rhode Island, *Water resources research, Administration, Research priorities, Planning, Cooperatives.

The State of Rhode Island is very active in water resources development and management activities which include legislation, building of treatment facilities, and instituting pretreatment programs. Current and anticipated state water problems are lack of comprehensive and definitive water policies, contamination of groundwater by toxic chemicals from agricultural, road-salting, septic-tank cleanup, landfill, and gasoline storage practices, lack of a water data information system, the need of a program to improve the management of septic tank leaching field systems, and restructuring a price scheme for water supply and wastewater discharge. Four research projects covering subjects of Resonance Raman Method for Bacteria Detection and Identification; Acid Precipitation; Combined Sewer Overflow Management Modeling; and River Nitrification are completed. A fifth project on Chemical Nitrification Inhibition will be carried over to the FY-1984 Cooperative Program. This center works closely with the R. I. Dept. of Management, Subdistrict Office of USGS in R.I., Narragansett Bay Water Quality Commission, as well as with other New England Water Resources Centers for research projects and program planning.
W86-02490

FINAL PROGRAM REPORT: FISCAL YEAR 1983 MISSISSIPPI WATER RESOURCES RESEARCH INSTITUTE,
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
M. T. Bond.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214898/AS, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, September, 1984. 10 p. USGS G851-01. 14-08-0001-G-851.

Descriptors: *Mississippi, Conjunctive use, Computer models, Aquifers, Management planning, Institutional aspects, Legal aspects, Organizations, Industrial water use, Water conservation, Information exchange.

This publication is a summary of the Mississippi Water Resources Research Institute Annual Program with U.S. Department of Interior for the Fiscal Year 1983. Synopses of the following activities and research are included: (1) Director's Office; (2) Institutional Framework for Conjunctive Use of Surface and Ground Water; (3) Mathematical Models for Water Reources Policy and Management with Application to the Eutaw-McShan Aquifer; (4) Incentives for Industrial Conversion to Surface Water; and (22) Water Resources Technology/Information Transfer.
W86-02492

1983 WATER RESEARCH INSTITUTE PROGRAM FINAL REPORT, (MAINE),
Maine Univ. at Orono. Land and Water Resources Center.
S. N. Landry, and L. Y. Breece.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214971/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Final Report, Orono, November 1984, 23 p, 2 fig, 5 tab. USGS G846-01.

Descriptors: *Acid Rain, Administration, Chromium, *Clays, Groundwater Pollution, *Maine, Information Exchange, *Macroinvertebrates, Potable Water, *Radioactivity, *Technology Transfer, *Water Resources Institutes.

Four research projects and a technology transfer component were funded with FY-83 monies: Effects of Acidification on Pond and Stream Macroinvertebrates (G846-02): Suitability of Marine Clays as Liners for Hazardous Waste Disposal Sites (G846-03); Radon in Houses Due to Radon in Potable Water (G846-04); A Kinetic Study of the Effects of Acid Rain on Trace Metal Uptake at Surfaces (G846-05); and Technology transfer in Water Resources Management (G846-22). Projects G846-03 and G846-05 were completed under this grant, and the others continue into the next program year. In the 'clay liners' study it was found that the permeability of Maine's marine clays seemed unaffected under tests with solvents within the time frame of the project's permeameter test; longer-duration testing would yield more conclusive determinations regarding the suitability of these clays as liners at hazardous waste disposal sites. The metal uptake study indicated that rates and mechanism of reaction of Cr(III) with iron oxide are similar to those observed for reactions of Cr(III) with anions in solution; comparisons of the rate of reaction of a metal with a simple carboxylic acid in contrast to an iron oxide surface or with a humic acid component should indicate the relative rates of important processes in natural water systems, and how these processes can be affected by changes in pH such as when acid rain is evident. Initial work with selected macroinvertebrates (-02) has indicated that a process similar to encapsulation in fish eggs exposed to low pH may occur in C. triangulifer allowed to develop at pH 4.0; future experiments to determine effects of Al and Ca on hatching of eggs, survival, growth, and molting success of nymphs, and emergence success and fecundity of adults, will be concentrated within that range. In the radon project the researchers have attemped to determine relationships between indoor airborne radon levels and certain weather parameters, domestic water use, and building ventiliation; these parameters are being incorporated into a mathematical model that can be used to predict average radon doses to building occupants, and to evaluate the effectiveness of radon removal equipment. The technology transfer component of the program facilitates the exchange of information on Maine water resources issues between the researchers and the consumers, who range from state policy-makers to homeowners concerned about contaminants in their drinking water. Information is disseminated through workshops, conferences, and publications. Topics covered during this program year were acid deposition, radon in groundwater, hazardous wastes disposal, land use laws, use conflicts on Maine's rivers and streams, and Maine peatlands.
W86-02500

NINETEENTH ANNUAL REPORT PROGRAM ACTIVITIES, OCTOBER 1, 1982 - SEPTEMBER 30, 1984, MARYLAND WATER RESOURCES RESEARCH CENTER,
Maryland Water Resources Research Center, College Park.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-214997/AS, Price codes: A05 in paper copy, A01 in microfiche. Annual Report, (1984), 93 p, 10 tab, 13 fig, 66 ref. USGS G847-01.

Descriptors: *Maryland, *Water resources research, *Groundwater, *Water pollution effects, Nutrients.

This report covers the program activities of the Maryland Water Resources Research Center's four projects for the period October 1, 1982 through September 30, 1984. Two of the projects will be continued during the fiscal year 1984. The projects covered in this report are: (1) Nitrogen and Phosphorus Losses Via Subsurface Ground Water Flow From Conventional and No-till Corn Watersheds, (2) Effects of Disinfection Techniques on Chesapeake Bay Sediments, (3) Accumulation of Toxic Metals in Wetland Areas of Two Eastern Shore Rivers, Implications for Water Quality, and (4) The Impact of Point and Non-point Nutrient Enrichment on the Dynamics of Natural Phytoplankton.
W86-02502

FISCAL YEAR 1983 INSTITUTE FINAL PROGRAM REPORT, WASHINGTON WATER RESEARCH CENTER,
Washington State Water Research Center, Pullman.
W. H. Funk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215069/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Program Report, December 1984, 28 p. USGS G876-01.

Descriptors: *Research , *Information transfer, Student training, *Washington, Modeling, Irrigation, Columbia River Basin, Conflicting use, Fisheries, Salmon propagation, Roughfish control, Algae, Algal dominance, Zooplankton grazing, Flood routing, Flood control, Acid rain.

The state of Washington water concerns and problems arre indicative of regional problems in the Columbia and Snake River drainage basins. Eighty percent of the electrical needs of the region are met by hydro-produced power. Although the state appears water-rich, there are increasing conflicts over the use of water resources which include irrigation withdrawal and return flow, erosion, power production, fish propagation and migration, barging transportation, effluent dilution, flood storage, and recreation. In addition, there is high usage and value placed on the smaller rivers and streams of the state as well as lakes. Concern for water resources leads to research of state and national significance in conflict resolution, mitigation of water and fisheries problems due to hydro development, irrigation return flow, excess nutrients, acid rain, eutrophication of lakes and reservoirs, food chain relationships, and water storage.
W86-02509

FISCAL YEAR 1983 PROGRAM REPORT, NEW HAMPSHIRE WATER RESOURCES RESEARCH CENTER,
New Hampshire Univ., Durham. Water Resources Research Center.
G. L. Byers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-215077/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Program Report, Sept 1984. 20 p. USGS G856-01.

Descriptors: *Water Research, *New Hampshire, *Acid rain, Water conservation pressures, Aluminum, Stream invertebrates.

The Program of the New Hampshire Water Resource Research Center included three projects which focused on acid rain phenomenon, and one that studied public reaction towards water conservation pressures. This report includes a brief discussion on the release of aluminum in drinking water supplies, the impact of increased acidity on stream invertebrates, and how watershed characteristics may interact with acid precipitation. A brief discussion is included on the acid slug effect of spring runoff (snowmelt). The attitudes of people towards imposed conservation measures and some of the conclusions drawn from the study are discussed. A listing of publications and papers presented is included.
W86-02510

FISCAL YEAR 1983 PROGRAM REPORT, MASSACHUSETTS WATER RESOURCES RESEARCH CENTER,
Massachusetts Univ., Amherst. Water Resources Research Center.
P. J. Godfrey, and E. R. Kaynor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216885/AS, Price codes: A03 in paper copy, A01 in microfiche. Annual Report for Fiscal Year 1983, December 1984. 30 p. USGS G848-01.

Descriptors: *Water Resources Institutes, *Massachusetts, *Water resources research, Training, Education.

This report summarizes the activities of the Water Resources Research Center at the University of Massachusetts for the period October 1983 to September 1984. It contains a Director's Message, summaries of four projects supported by the United States Geological Survey, 19 projects supported by state and private grants, education and training functions of the Center, and a summary of the water resource research needs of the Commonwealth of Massachusetts.
W86-02519

FISCAL YEAR 1983 INSTITUTE PROGRAM REPORT, (VIRGINIA WATER RESOURCES RESEARCH CENTER),
Virginia Water Resources Research Center, Blacksburg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-216919/AS, Price codes: A02 in paper copy, A01 in microfiche. Final Program Report, April 1985. 18 p. USGS G874-01.

Descriptors: *Water management, *Water quality, *Land use, *Urban runoff, *Agricultural runoff, *Information retrieval, *Public participation, *Technology transfer, Forest watersheds, Water quality data, Indexing, *Virginia.

This report summarizes the sponsored research, technology transfer/information dissemination, and state and local cooperative efforts of the Virginia Water Resources Research Center during 1983. In all its activities the Center cooperated extensively with state and local officials and agency personnel through a Statewide Advisory Committee and a system of ad-hoc advisory committees for particular projects. Three research projects were sponsored. The first reviewed land use impacts on water resources in Virginia and outlines topics needing additional research. The second project examined issues related to the design of a water quality data clearinghouse for Virginia, and suggested that a clearinghouse should be developed progressively as part of an already existing system, such as NAWDEX or STORET. Project three analyzed the water resource public participation programs of 31 states, compared them with the prescriptions found in the literature, and provided recommendations for expanded public involvement. Information dissemination activities included publication of a monthly newsletter, bulletins, a special report, and an examination of options for change in southeastern states' systems for water management. Center staff also conducted a water/energy conservation education program and developed an interactive unit in wildlife management and a groundwater education program.
W86-02522

FISCAL YEAR 1983 PROGRAM REPORT OF THE WATER RESOURCES RESEARCH INSTITUTE OF NEW YORK STATE,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217024/AS, Price codes: A02 in paper copy, A01 in microfiche. Final Program Report, Sept 1984. 17 p. USGS G859-01.

Descriptors: Groundwater protection and management, Acid precipitation, *Water resources planning, *New York.

The Institue Water Resources Research Program for FY 1983 focused on three problem areas identified as critical in the Middle Atlantic Region: groundwater protection and management; acid precipitation; and water resources planning. The groundwater protection and management research program addressed problems of quality protection and the technology transfer program focused on related problems of management and information dissemination. The latter program was and is carried out in close coordination with the New York State Department of Environmental Conservation, and included special training sessions for staff of the NYSDEC. The Institute participated in the development of State policy in the groundwater area, as well as in the development of the scientific base for that policy. The acid precipitation research projects focused on the effects of the phenomenon: on tree pollen germination and tube growth and use of induced fluorescence measurements to assess aluminum-organic interactions in acidified lakes. The project relating to water resources planning developed a methodology for estimating the frequency, severity and duration of water supply shortages in existing water supply systems which rely on both surface and ground water. The methods were applied to an area troubled by water shortages due to both episodic and chronic contamination of the water supply sources.
W86-02533

FY 1983 DELAWARE WATER RESEARCH INSTITUTE, PROGRAM FINAL REPORT,
Delaware Univ., Newark. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217693/AS, Price codes: A02 in paper copy, A01 in microfiche. 1984. 10 p. USGS G-833/01.

Descriptors: *Delaware, *Water resources research, Storm runoff, Management planning, Groundwater pollution, Sanitary landfills, Aerobic digestion, Biological oxidation, Activated carbon, Adsorption, Hydrologic budget, Water shortage, Groundwater, Nitrates, Nitrification, Kinetics, Technology transfer.

The FY 1983 Delaware Water Research Institute Program was responsive to the water problems of Delaware and the surrounding region. Groundwater management and contamination have been identified as high priority research needs, and three of our 1983 research projects focused on groundwater contamination. A second area cited as a high priority regional and Delaware water problem is wastewater treatment, and two of the projects included in our FY 1983 program involved research into improved treatment methods. The need for improved water resources planning has continued to appear as a problem area over the years, and one of the research projects in our FY 1983 program addressed this issue. The final component of our 1983 program consisted of two technology transfer projects; one resulted in a newsletter, the other in a computer-based program for the selection of techniques to mitigate the impacts of urban stormwater. The FY 1983 Program Final Report contains an informative abstract outlining these projects, as well as a synopsis of each including the purpose and objectives, the methods and procedures, principal findings, conclusions, and publications produced.
W86-02534

FY 1983 INSTITUTE FINAL PROGRAM REPORT (TENNESSEE WATER RESOURCES RESEARCH CENTER),
Tennessee Water Resources Research Center, Knoxville.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-217768/AS, Price codes: A03 in paper copy, A01 in microfiche. Tennessee University, Knoxville, Water Resources Research Center. Final Program Report, September 1984. 19 p. USGS G870-01.

Descriptors: Water Resources Research Institute, *Tennessee, Water pollution control, Erosion control, Information transfer, Acid rain.

This report details FY 83 research work accomplished by the Tennessee Water Resources Research Center under the Department of Interior's Annual Cooperative Program. Foremost was the desire of the Tennessee Water Resources Research Center to direct its funded research efforts towards environmental and growth related issues identified by Governor Alexander's Safe Growth Action Team. Specifically, these issues revolved in and around aspects of water and hazardous wastes; (1) a comprehensive evaluation of water law and policy for the State, leading to resolution of legal and institutional restraints on water resources planning and management; (2) a variety of economic, social and political studies relating to problems of government in coping with water resources needs and responsibilities and (3) technical research projects in engineering and in the physical and life sciences designed to assist in resolving such problems as erosion, impact of strip-mining, groundwater pollution and eutrophication. This report provides an overview of five (5) research projects/activities: (1) Biological Detoxification of Hazrdous Wastes; (2) Effects of Acid Precipitation on Composition, Electrokinetic Behavior, Cation Adsorption and Ion Exchange Capacity in Various Soil Systems; (3) Prevention of Gully Formation and Associated Water Degradation; (4) Evaluation of Tennessee Sites for the Disposal of Hazardous Wastes--Social, Economic and Technical Considerations and (5) Information Dissemination/Technology Transfer Program.
W86-02541

LOUISIANA WATER RESOURCES RESEARCH INSTITUTE, FY 1983 PROGRAM REPORT.
Louisiana Water Resources Research Inst., Baton Rouge.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-218998/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Completion Report, 1984, 57 p. USGS G845-01.

Descriptors: *Louisiana, *Technology transfer, Water resources, Water pollution control, Coal wastes, Nutrient assimilation, Lakes.

Five projects were supported by the Louisiana Water Resources Research Institute during the year 1983-84. One project related to technology transfer, and the remaining four were research projects. The technology transfer project reaffirmed the need for continued water resources research and subsequent transfer of research results to the user-community. The research projects covered a broad spectrum of environmental and water resources area. One project dealt with mathematical modeling of streamflow. The other project dealt with development of techniques for sediment analysis to isolate, concentrate and detect chlorinated hydrocarbons. Another project concentrated on treatment of coal pile runoff in Louisiana and suggested ways for treating this wastewater most effectively. The last project dealt with nutrient assimilation capacity in two shallow coastal lakes. It was found that total nitrogen concentrations in

water draining into the lakes generally exceeded concentrations already in the existing lake.
W86-02546

INFORMATION DISSEMINATION FOR A BETTER UNDERSTANDING OF LOUISIANA'S WATER RESOURCES,
Louisiana State Univ., Baton Rouge. Hazardous Waste Research Center.
B. Worm.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-219079/AS, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, Louisiana Water Resources Research Institute, Baton Rouge, September 1984. 31 p, 3 tab, 2 ref, 4 app. USGS G845-22.

Descriptors: Education, Research priorities, *Coastal zone management *Louisiana, *Information transfer.

This project involved the assessment of Louisiana citizen's needs for water resources information, and the identification, preparation, and dissemination of the information available through the Louisiana Water Resources Research Institute to meet these needs. During the needs assessment phase, it was found that a need for information on most aspects of water resources exists in Louisiana. One topic of major concern for the State, coastal zone water problems, has been addressed by Institute-supported research, and the results of this research was used to develop educational materials for the public on these problems. A brochure was prepared to explain the complex, interrelated nature of coastal water and water-related problems. This material was prepared for distribution to the libraries and local governments of the communities affected by the problems addressed as well as to appropriate state government offices. This project, through the evaluation of the Institute's ability to satisfy the State's needs for water information through existing Institute information, revealed gaps between needs for information and existing information. An updating of the Institute's research priorities was, therefore, proposed as a means of helping fill the gap between information needs for the State and information available through the institute. Those topics not previously addressed by the Institute were recommended for incorporation into the Institute's water research priorities listing.
W86-02554

FISCAL YEAR 1983 PROGRAM REPORT INDIANA WATER RESOURCES RESEARCH CENTER,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. H. Cushman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225829/AS, Price codes: A03 in paper copy, A01 in microfiche. December, 1984. 90 p. USGS G841-01.

Descriptors: *Water resources research, *Indiana, Path of pollutants, Overland flow, Water pollution control, Shellfish, Water management.

A compilation of project summaries for the Fiscal Year 1983. These projects include studies of groundwater pollutant transport, overland flow, control of non-point pollution control, growth of mussels, simulation of drought management, and technology transfer.
W86-02558

1983 CALIFORNIA WATER RESOURCES INSTITUTE PROGRAM FINAL REPORT,
California Univ., Davis. Water Resources Center.
J. H. Synder, J. DeVries, and R. J. Woods.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-225837/AS, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, (Sept. 1984.) 17 p. USGS G828-01.

Descriptors: *Water Resources Institutes, *Administrative agencies, *Chaparral, *Wetlands, *Economic aspects, *Irrigation practices, *Fish, *Groundwater recharge, Watershed management, Channels, Irrigation, Drip irrigation, Streamflow, Wells, *California.

This report is a synopsis of the results of research projects sponsored under Grant Program G-830, the 1983 Water Research Institute Program (WRIP) for the University of California's Water Resources Center. The California WRIP package is a subset of the Center's overall research program effort and contains six one-year projects investigating the following areas: Clarification of Surface Waters for Recharge Through Wells, Temperature Requirements of Pacific Coastal Stream Fishes, The Implications for Total Water Demand from the Adoption of Drip Irrigation in Western Agriculture, An Economic Approach to the Estimation of a Dynamic Production Function for an Irrigated Crop, Channel and Flow Relationships in Tidal Salt March Wetlands, and Chaparral Management Effects on Water and the Environment.
W86-02559

DISTRICT OF COLUMBIA WATER RESOURCES RESEARCH CENTER, FY 83 INSTITUTE FINAL PROGRAM REPORT,
District of Columbia Univ., Washington. Water Resources Research Center.
M. H. Watt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-226009/AS, Price codes: A03 in paper copy, A01 in microfiche. Report No. 60, September 1984. 45 p. USGS G834-01.

Descriptors: *Groundwater, *Urban hydrology, *Unit-day-values, *Urbanization, *Non-point sources, Dewatering, Statistical methods, Water quality, Run-off, Microcomputers, Recreation, Seminars, Mathematical models, Water pollution sources.

This FY 83 Institute Final Program Report presents the completed and continuing projects that the D.C. Water Resources Research Center conducted between August 1, 1983 and September 30, 1984. These projects are: 1) evaluation of the impact of urbanization on the hydrogeological conditions of the Fall-Line Cities; 2) Development of frequency functions for urban non-point risk evaluation; 3) Derivation of unit-day-values for recreation benefit valuation in water resource planning based on a comprehensive theoretical framework; 4) Identification and prioritization of the water resources problems and research needs in the District of Columbia; 5) Development of an improved test for the determination of biochemical oxygen daemand; 6) Model of flow and non-point source pollution in the tidal portion of the Potomac River; and 7) Assessment of the impact of non-point source pollutants on an urban river. Also, the activities of the Center included seminars which are described in the report.
W86-02576

FISCAL YEAR 1983 ANNUAL REPORT OF THE WYOMING WATER RESEARCH CENTER,
Wyoming Water Research Center, Laramie.
R. W. Brocksen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-226348/AS, Price codes: A03 in paper copy, A01 in microfiche. Final program report, September 1984. 68 p, 2 fig, 2 tab, append. USGS G879-01.

Descriptors: *Wyoming, *Water resources research, Universities, Colorado River Basin, Water resources development.

The State of Wyoming is considered to be a water producing state to the Colorado River Basin, the Snake River Basin, and the Missouri River Basin. Approximately 15.5 million acre feet of water is produced in Wyoming annually, with approximately 12 million acre feet obligated for downstream use through compacts and treaties. Wyoming has embarked on a large-scale water development program with the intended purpose of capturing for its use as much of the excess water produced as possible. The problems associated with the capture, diversion, dispersal, and re-use of these water resources are encompassing. In addition, being better able to forecast quantity and quality of water availability to downstream users is extremely important. To address the problems and generate needed information associated with water conservation, development, and re-use, a truly interdisciplinary effort, well-managed and coordinated, is essential. The Wyoming Water Research Center is organized in such a manner and can call on the diverse set of disciplinary expertise necessary to address key issues for the state and the region.
W86-02581

FY1983 FINAL PROGRAM REPORT FOR THE WATER RESOURCES RESEARCH CENTER, THE UNIVERSITY OF ARIZONA, TUCSON, ARIZONA,
Arizona Water Resources Research Center, Tucson.
L. G. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227213/AS, Price codes: A03 in paper copy, A01 in microfiche. FY83 Final Program Report, Sept. 1984, 42 p. USGS G828-01.

Descriptors: *Arizona, *Water resources research, Grants, Water use, Water conservation, Groundwater, Irrigation, Water reuse, Water quality, Flood forecasting.

Projects supported by the FY83 program related to the following four priority issues of state and regional importance: Water conservation, water utilization, water control and ground-water quality. The water conservation projects dealt with irrigation scheduling and household reuse and conservation. Among the water utilization projects was a project dealing with the economics of water importation into a southwestern community and a project examining the effect of the Southern Arizona Water Rights Act of 1981 on the political influence of the Papago nation. Four projects related to water control. One project was aimed at developing an automated flood warning system for the Southwest. A second project examined the role of paleoflood hydrology in forecasting extreme flood events. A third project examined rainfall-runoff models in a southwestern city. A fourth project evaluated models for predicting water retention and spillage in small stockponds in Southern Arizona. Two projects dealt with groundwater pollution by volatile organic compounds (VOC's) in the Southwest. One project is characterizing seasonal and diurnal fluctations of VOC's in the vadose zone overlying a pollution plume. The second project comprised writing a primer for sampling VOC's in ground water. The information dissemination activities of the Center included preparing a newsbulletin and project bulletins.
W86-02586

NEBRASKA WATER RESOURCES CENTER PROGRAM, FY 1983 REPORT,
Nebraska Water Resources Center, Lincoln.
W. L. Powers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227304/AS, Price codes: A02 in paper copy, A01 in microfiche. Program Completion Report (1984). 11 p. USGS G854-01. 14-08-0001-G854.

Descriptors: *Nebraska, *Water management, Groundwater, Surface waters, Lakes, Eutrophication, Grants.

This program report discussed eight projects in the Nebraska Water Resources Center research program for FY 1983. Projects are divided into two broad categories of Water Quantity and Management, and Water Quality. Under Water Quantity and Management, four projects deal with the major water problems in Nebraska. Declining groundwater tables are a problem in many Great Plains states. Project 854-02 provides a mechanism for comparing management alternatives necessary to effective groundwater management. The other three projects in this area relate to conservation of water supplies. Project G854-08 compares two

methods for measuring evaporation and transpiration for corn, sorghum and soybeans. G854-07 and G854-09 examine techniques for maximizing the effectiveness of limited amounts of water. There are four projects under Water Quality. Project G854-03 related to the problem of eutrophication of area lakes. G854-04 examines the problem of surface runoff as a potential vehicle for transmitting pseudorabies virus from swine facilities. G854-05 relates to the problem of irrigation on sandy soils and involved an effort to improve the estimates of nitrate movement in sandy soils. Project G854-06 studied the mixing and movement of nitrate-nitrogen within an aquifer. Snyopses of these projects are included in this program report.
W86-02595

FLORIDA WATER RESOURCES RESEARCH CENTER, ANNUAL INSTITUTE PROGRAM REPORT, 1983,
Florida Water Resources Research Center, Gainesville.
J. P. Heaney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-227312/AS, Price codes: A02 in paper copy, A01 in microfiche. Program Report, December 1984, 20 p. USGS G835-01.

Descriptors: *Florida, Water resources, Groundwater, Pesticides, Citrus, Models, Biological waste treatment.

The 1983 Annual Institute Report for Florida contains synopses of the following four studies which were supported by this program: 1. Aldicarb Studies in Groundwaters from Citrus Groves in Indian River County, Florida by Forrest E. Dierberg of Florida Institute of Technology; 2. Extension of Simplified Models Developed for Groundwater Quality Simulation, by Barry A. Benedict, University of Florida; 3. Biological Flocculation in Waste-grown Algal Cultures, by Ben Koopman and Edward P. Lincoln of the University of Florida; and 4. Dissemination of Water Related Information Within the State of Florida, by James P. Heaney of the University of Florida. Ten reports were published in 1983 including a comprehensive study of Florida's lakes. Runoff, the quarterly newsletter, was sent to over 1100 readers including 130 faculty. A major research study on hazardous wastes was initiated with support from the U.S. Air Force.
W86-02596

FY 1983 INSTITUTE FINAL PROGRAM REPORT - NEW MEXICO,
New Mexico Water Resources Research Inst., Las Cruces.
T. G. Bahr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-229813/AS, Price codes: A02 in paper copy, A01 in microfiche. Final Program Report, September 1984. 17 p. USGS G-858-01.

Descriptors: *New Mexico, *Water resources research, Personnel, Water management, Water rights, Water resources development, Hydrology institutional constraints.

The Fy 1983 research program funded cooperatively by the U.S. Geological Survey and the New Mexico Water Resources Research Institute supported four research projects and one technology transfer project. These projects addressed questions in three of New Mexico's five major water problem areas. Water quality problems associated with increasing industrial demand were the topic of two of the projects, while one project each investigated groundwater recharge and water demand projection. One of the water quality projects has developed a methodology for monitoring heavy metal concentrations in natural waters on a real-tie basis. The technique is based on anodic stripping voltammetry. The second water quality project looked at Gas Chromatographic/Mass Spectrometric techniques for identifying toxic organic compounds in natural gas pipeline hydrostatic test water. The project will continue in FY 1984 with a shift in emphasis to looking at water generated as a result of drilling and production operations. Groundwater recharge is a critical issue in New Mexico. New ways are needed to estimate current and historic levels of recharge. This study used radio and stable isotope techniques to age groundwaters associated with coal bearing formations in New Mexico an estimate prehistoric climates and recharge rates. The final research project in the joint federal-state program looked at the techniques needed for projecting future water demand from economic and demographic data. The project used the Arkansas, Red, White River basin area of New Mexico as its case study location.
W86-02610

WISCONSIN WATER RESOURCES CENTER, FINAL PROGRAM REPORT FY 1983.
Wisconsin Univ.-Madison. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-230050/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Program Report, Sept 1984. 40 p, 2 fig, 30 ref. USGS G878-01. 14-08-0001-G878.

Descriptors: *Path of pollutants, *Wisconsin, Education, Groundwater, Organizations, Technology transfer, Training, Water Resources Institutes.

The issue of primary concern addressed by the FY 1983 Wisconsin Water Resources Research Institute Program was the transport of contaminants to and through the groundwater system. Of particular concern were (1) pesticide movement to groundwater from agricultural uses in irrigated sandy soils and its vertical and horizontal dispersion in the groundwater; (2) the impact of dewatering a lead mine on the movement of lead, arsenic, magnesium and sulfate to groundwater; and (3) the importance of adsorption/desorption reactions in the root and vadose zones of soil in transport of contaminants to groundwater. This research has allowed us to begin to determine the minimum amount of information to predict whether a particular location is sensitive to transport of materials through soils to groundwater; the physical and chemical properties of organic and inorganic compounds related to the ease of their transport to groundwater; the dispersion of contaminants in flowing groundwater; and the time required for contaminants to reach nonthreatening concentrations in the groundwater. The sites chosen for investigation include areas where there are important contaminant threats to groundwater in Wisconsin and the region. Three Ph.D. students (Environmental Toxicology, Geology and Geophysics, and Water Chemistry) were supported by the FY 1983 Wisconsin WRC program. In addition hourly help students have been provided with 1200 hours of training in scientific field work, library references services, and computer cataloging.
W86-02613

FY 1983 FINAL REPORT--STATE WATER RESOURCES RESEARCH INSTITUTE PROGRAM, UNIVERSITY OF GUAM.
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-230076/AS, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report (1984), 17 p. USGS G837-01.

Descriptors: *Guam, *Research institutions, *Technology transfer, *Information exchange.

An overview of the organizational structure and mission of the University of Guam Water and Energy Research Institute is given. Synopses of research projects undertaken in FY 1983 are also given. Four were completed; one was terminated; and one is continuing into the next fiscal year. The titles of these projects are: Completed--(1) Technology Transfer; (2) A Hydrogeologic Investigation of Atoll Islands, Ponape State, Eastern Caroline Islands; (3) A Comparison of Fresh Water Use Customs on Ulithi Atoll with those of Selected other Micronesians Atolls; (4) A Comparative Study of Sewage Treatment by a Capillary Siphon Trench System versus a Conventional Leaching Trench System; Terminated--(1) Feasibility Study of Tracer Utilization to Determine Hydrodynamic Properties of Limestone Units in Northern Guam; Continuing--(1) Solar Pumping of Groundwater as a Source of Irrigation Water for Remote Areas of Southern Guam.
W86-02615

F.Y. 1983 INSTITUTE FINAL PROGRAM REPORT, (MISSOURI WATER RESOURCES RESEARCH CENTER),
Missouri Water Resources Research Center, Columbia.
T. E. Clevenger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-230084/AS, Price codes: A03 in paper copy, A01 in microfiche. Institute Report, Sept. 1984. 24 p. USGS G-852-01. 14-08-0001-G-852.

Descriptors: Computer modeling, Water management, Soil absorption capacity, Groundwater pollution, Waste water treatment, Land disposal, *Missouri, *Water resources research.

Research areas covered under the 1983 Fiscal Year for the Missouri Water Resources Research Center are: a) Aspects of Water Quantity, b) Water Policy, Planning and Adjudication, and c) Quality of Surface and Groundwaters. Four proposals were funded during this period with two in Water Quality, one each in Water Quantity and Water Policy. Water Quality: 1) Organic Groundwater Contamination Evlauation and Prediction, and 2) Decreasing Hydraulic Conductivity of Hazardous Waste Clay Barriers by Internal Chemical Reactions - Phase One of Two Phases. Water Quantity: 1) Quantitative Aspects of Water Resources Management for the State of Missouri. Water Policy: 1) Land Application of Sewage Effluent for Missouri Water Resources Conservation and Pollution Control.
W86-02616

FISCAL YEAR 1983, PROGRAM REPORT, MONTANA WATER RESOURCES RESEARCH CENTER,
Montana Water Resources Research Center, Bozeman.
H. S. Peavy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-230126/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Program Report, February 1985. 48 p. USGS G-853-01. 14-08-0001-G853.

Descriptors: Administration, Grants, *Research projects, *Information transfer, *Water resources research, *Montana.

The organization and operation of the Montana Water Resources Research Center programs for the period of October 1, 1982 to September 30, 1984 is described. Included are statements regarding the authorization, funding, role and organizational structure of the Center. The Water Center is outlined and synopsis of the 1983 research and information transfer projects are included. Several projects funded under other fiscal year programs were either completed or begun during FY 1983. A list of the publications resulting from projects reported in this document, along with a list of student trainees, is also included.
W86-02620

FINAL PROGRAM REPORT FOR THE FY1983 NEVADA WATER RESEARCH INSTITUTE PROGRAM,
Nevada Univ. System, Reno. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232775/AS, Price codes: A02 in paper copy, A01 in microfiche. Sept., 1984. 5 p. USGS G855-01. 14-08-0001-G-855.

Descriptors: *Nevada, Water Research Institute Program, *Recharge, Irrigation, Reservoir models, *Water resources research.

The Nevada research program for FY1983, funded in part by the U.S. Department of the Interior as authorized by the Water Research and Development Act of 1978 (P.L. 95-467), is described. Three research projects were undertaken, namely: Water Harvest and Artificial Recharge; Analysis of the Economics of Irrigation Pumping, and Distribution Efficiences; and Uncertainty in Modern Impoundment Models/Effects and Methods of Analysis. Abstracts of these research projects are provided.
W86-02622

FY 1983 (SOUTH DAKOTA WATER RESOURCES RESEARCH INSTITUTE) FINAL PROGRAM REPORT,
South Dakota State Univ., Brookings. Water Resources Research Inst.
A. R. Bender.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232833/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Program Report, March 1985. 28p. USGS G869-01. 14-08-0001-G-869.

Descriptors: *South Dakota, *Water research, *Irrigation, *Drainage, *Groundwater, *Radiochemical analysis, *Glacial soils.

The FY 1983 South Dakota Water Research Institute program consisted of five research projects in three general areas: (1) water use and management, (2) groundwater quality, (3) dynamics of groundwater systems. These projects develop information necessary to improve the economic and personal well-being of the citizens of the state and region. The report contains a synopsis of each of the following projects: G-869-02, Conservation tillage and irrigation management practices for optimum crop production; G-869-03, Effective use of soil amendments on prevention and reclamation of irrigation-induced sodic soils; G-869-04, Monitoring leachate treatment provided by a groundwater interception trench at a solid waste landfill; G-869-05, Radium -226 and -228 in the groundwater of southeastern South Dakota; and G-869-06, Characterizing water movement in the weathered zone of glacial tills under continuous irrigation.
W86-02628

1983 INSTITUTE PROGRAM REPORT, NEW JERSEY,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
A. W. McIntosh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232882/AS, Price codes: A02 in paper copy, A01 in microfiche. Final Program Report, March, 1985. 14 p. USGS G857-01. 14-08-0001-G-857.

Descriptors: *Acid rain, Organic compounds, Groundwater pollution.

The 1983 program focused on two key issues within New Jersey: (1) toxic substances in the ground water, and (2) acidic deposition. Two projects ('Toxic Chemical Transport and Fate in Groundwater Systems' by Drs. R. Ferrara and W. G. Gray, and 'Buffer Capacities of Freshwater Lakes Sensitive to Acidic Rain and Leaching of Toxic Metals from their Sediments' by Dr. S. Faust) have been completed, while three other projects in these categories are continuing during the fiscal year 1984 program.
W86-02633

HAWAII WATER RESOURCES INSTITUTE PROGRAM: FISCAL YEAR 1983,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
L. S. Lau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232916/AS, Price codes: A02 in paper copy, A01 in microfiche. Final Program Report, 1984. 17 p. USGS G838-01. 14-08-0001-G838.

Descriptors: *Water Resources Institutes, *Long-term planning, *Hawaii, *Water programs, Policy formulation.

A synopsis of the results of research projects sponsored under Grant Program G-838, the 1983 Water Research Institute Program (WRIP), is reported for the University of Hawaii at Manoa's Water Resources Research Center. The Hawaii WRIP projects are a portion of the Center's total research program and include seven projects: Development of Methods to Recover and Culture Infectious Human Rotavirus from Sewage and Natural Waters; Chemical Constituents of Rainfall at Different Locations in Hawaii; An Evaluation of the Economic Efficiency of the Property Rules Resulting from the Reppun Decision; Habitat Preferences of Hawaiian Stream Fishes; Estimation of Water Use Coefficients and Multipliers for Oahu; Dynamic Response of the Lower Boundary of a Basal Aquifer to Surface Disturbances; and Journal Reprints and Unpublished Papers Relevant to Water Resources in Hawaii: Information Transfer.
W86-02636

FISCAL YEAR 1983 PROGRAM REPORT, WATER RESOURCES RESEARCH CENTER (MINNESOTA),
Minnesota Univ., St. Paul. Water Resources Research Center.
G. R. Blake.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232924/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Program Report, St. Paul, Oct. 1984. 25 p. USGS G850-01. 14-08-0001-G-850.

Descriptors: *Coordination, Administration, Policy, State agencies, Objectives, *Research and development, *Grants, *Minnesota, *Water Resources Research.

The Fiscal Year 1983 Program Report of the University of Minnesota Water Resources Center presents a summary of activities for fiscal year 1983. It covers the period October 1, 1982 through September 30, 1984. The report describes the research activities of the Center, its involvement in training water scientists and its efforts in transferring technologic information to potential users. Research progress reports of six sponsored projects are included in the report. A summary of students employed and given water sciences training through the Water Resources Center are presented.
W86-02637

POLICY AND ORGANIZATIONAL CONSIDERATIONS FOR IMPROVING TRANSFER OF UNIVERSITY RESEARCH INFORMATION AND EFFECTING AVAILABILITY OF EXPERTISE TO STATE AGENCIES,
Minnesota Univ., St. Paul. Water Resources Research Center.
G. R. Blake.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232932/AS, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, St. Paul, July, 1984. 36 p. USGS G850-22. 14-08-0001--G-850.

Descriptors: Coordination, Administration, Policy, *State agencies, Procedures, *Minnesota, *Water Resources Research.

The troubled state of financing of the Water Resources Research Center (WRRC) precipitated a review of the WRRC, its role, its relation to other water resources units or programs in the University, its administrative structure and its financing. An ad hoc committee appointed by the University Vice President reported back with its recommendations on the role of WRRRC, in research, in coordination, and in communication and outreach. The ad hoc report was supportive of the need for strengthening and financially supporting an expanded role for WRRC. The University administration sensing a need for developing a coordinated mission for Natural Resources on its various colleges and campuses took action to set up a structure for that purpose. This consisted of appointing an Executive Council, a technical advisory committee and four resources sub-committees of which the Water Resources Subcommittee was one. The Water Resources Subcommittee if activated will probably set the goals and define the future role and authority of not only WRRC but also of other water Center in the University.
W86-02638

FY 1983 FINAL PROGRAM REPORT (TEXAS WATER RESOURCES INSTITUTE),
Texas Water Resources Inst., College Station.
W. G. Jordan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232965/AS, Price codes: A03 in paper copy, A01 in microfiche. Final Program Report, FY 1983, 1984. 32 p. USGS G-871-01. 14-08-0001-G-871.

Descriptors: *Texas, *Water management, Reservoir management, Conservation, Flood control, Secondary recovery, Ogallala aquifer, Unsaturated zone, Surface irrigation, Surge flow, Irrigation efficiency, Technology transfer methods, Effectiveness, New irrigation design.

The Institute's 1983 annual cooperative program consisted of four research projects that dealt in general with the efficient use of the state's surface and ground water resources. Current methods of reservoir operation were examined to determine if current policies provided for an optimum balance between flood control and conservation purposes. Redistribution of storage capacity between flood control and conservation has significant potential to improve the overall effectiveness of a reservoir system. This project will continue in 1984 with an intensive analysis of selected reservoirs. The remaining three projects dealt with enhanced recovery of ground water and its efficient use in irrigation. Enhanced recovery technologies have been applied to the Ogallala Aquifer with encouraging results. Air injection appears to force additional water from the unsaturated portion of the formation into the saturated zone. A large physical model has been designed to provide an experimental vehicle to verify and extend field results. Research on surge irrigation has produced a simple model to predict the impact of operational procedures on soil infiltration rates. This model permits prediction of the effectiveness of surge irrigation in improving water application efficiency for soils with different infiltration rates. Factors determining the rate of irrigation technology transfer were also studied with the conclusion that research agencies and farm pubications were the most important initial sources of information, but irrigation equipment dealers and company representatives were most instrumental in adoption of new technology. Adoption of the LEPA (Low Energy Precision Application) technology was the case under study.
W86-02641

INSTITUTE PROGRAM REPORT, FISCAL YEAR 1983, SOUTH CAROLINA WATER RESOURCES RESEARCH INSTITUTE.
Clemson Univ., SC. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-232999/AS, Price codes: A03 in paper copy, A01 in microfiche. Annual Report, September 1984. 76 p, 10 fig, 5 tab. Paul B. Zielinski, editor. USGS G-868-01. 14-08-0001-G-868.

Descriptors: *Water Resources Institutes, *South Carolina, *Water resources research, Universities, Education.

This report contains the summary statement of activities for the fiscal year 1983. Descriptions of eight (8) funded projects. Three (3) of these were funded with state funds only. Summaries of research funded through federal funds, five (5) proposals and synopsis of (5) federal funded research projects. Also, a description of the proposal development is included.
W86-02644

FINAL PROGRAM REPORT, FISCAL 1983, KANSAS WATER RESOURCES RESEARCH INSTITUTE,
Kansas Water Resources Research Inst., Manhattan.
F. W. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233021/AS, Price codes: A02 in paper copy, A01 in microfiche. January, 1985. 19 p. USGS G843-01.

Descriptors: *Kansas, *Water Resources Research, Water yield, Stream flow, Water conservation, Agricultural runoff, Simulation analysis, Water use efficiency, Interstitial soil pore water, Water shortage risk, Water rights.

More effective water use where it falls is a desirable goal for agriculture, but fuller utilization upstream means potentially less water available for downsteam users. New agricultural technology on nonirrigated areas is estimated to be reducing potential stream flow by 18 percent at present and projected to reduce it by 25 percent by year 2024. A study of irrigators in central Kansas indicated that improvements are needed in the form of more tailwater pits and reuse of the tailwater could be increased. This same study yielded information that is needed in order to establish a baseline study which is essential for adequate determination of management and control data. A diffusion model was formulated and used to describe mass transfer across the soil surface. The object of the research was to study the important component of pesticide transport process. Another study was concerned with providing an evaluation before making a decision on the future policy for operating a reservoir. As pertains to Kansas state water resources planning, it seems clear the state can and probably does indirectly tax water rights as a property right at least in some portions of the state.
W86-02647

FINAL PROGRAM REPORT FOR FISCAL YEAR 1983, (VIRGIN ISLANDS WATER RESOURCES RESEARCH CENTER),
Caribbean Research Inst., St. Thomas, VI. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233732/AS, Price codes: A02 in paper copy, A01 in microfiche. Annual Report, Sept 1984. 12 p. USGS G875-01. 14-08-0001-G-875.

Descriptors: *Virgin Islands, *Water Resources Institute, Program report, *Water resources research, Education, Universities.

The FY 1983 research program of the Virgin Islands Water Resources Research Center concentrated on assessment of water resources and present and future needs for the limited water resources in the Virgin Islands. Projects investigated the demand for water and quality of groundwater in St. Thomas, as well as the rainfall-runoff characteristics of basins in St. John. A method was developed to optimally size rain water cisterns and an international conference was held to discuss the water resources problems of islands of the eastern Caribbean.
W86-02651

FISCAL YEAR 1983 FINAL PROGRAM REPORT PENNSYLVANIA WATER RESEARCH INSTITUTE PROGRAM.
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233740/AS, Price codes: A03 in paper copy, A01 in microfiche. Report LW8406, Sept. 1984. 23 p. USGS G865-01. 14-08-001-G-865.

Descriptors: Streams, Aquatic productivity, *Technology transfer, Atmospheric deposition, Water conservation, Reservoir operation, Eutrophication, Nutrients, Forest soils leachate, Water allocation, *Pennsylvania, *Water Resources Institute, Education, Universities.

Program objectives pursued in the Fiscal Year 1983 Annual Cooperative Program included: evaluating the rate and extent of recovery of a stream, dominated by the growth of aquatic vascular plants, following a program of phosphorus removal; determining if the chemistry of soil and soil leachate in Appalachian forests varies with the amount of acidic atmospheric deposition; developing a flow management model to explore alternative approaches to future drought protection for the Monongahela River Basin, and examine possible impacts of modifications in reservoir operating policies and low flow consumptive use restrictions. In addition a program of technology transfer was directed to: improving the general public's understanding about atmospheric deposition in Pennsylvania; increasing the knowledge of local sewage enforcement officers and water managers about maximum level water conservation devices; and educating local government officials to the potential benefits of hydraulic load reduction through water conservation for malfunctioning on-lot sewage systems.
W86-02652

NORTH DAKOTA WATER RESOURCES RESEARCH INSTITUTE, ANNUAL COOPERATIVE PROGRAM FOR FY83,
North Dakota State Univ., Fargo. Dept. of Chemistry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233757/AS, Price codes: A02 in paper copy, A01 in microfiche. FY83 Final Program Report, (1984). 9 p. USGS G861. 14-08-0001-G861.

Descriptors: *North Dakota, *Water Resources Institute, Brine disposal, Evaporation, Terrain analysis, Oil industry, Seepage, Water pollution, Water resources research, Education, Universities.

In the fiscal year of 1983 the North Dakota Water Resources Research Institute carried out a program of research development, information dissemination and research action dealing with water problems important to North Dakota and relevant to other parts of the nation with similar water related problems. The research focus for FY83 was water contamination and water borne soil contamination resulting from oil drilling activities. Special emphasis was given to movement of water and water borne materials through the vadose zone of soil materials. A survey was taken of the extent of externally visible damage. A few test sites were chosen for specific examination of extent of salt migration from abandoned brine disposal ponds. Both lateral and vertical migration were explored and area mineralogy was characterized. The study is relevant to current as well as past practices since the injection well technology for brine disposal is apparently imperfect. Significant brine infiltration has been discovered near injection wells in addition to that found near abandoned brine disposal ponds.
W86-02653

OHIO WATER RESEARCH INSTITUTE PROGRAM FINAL PROGRAM REPORT, FISCAL YEAR 1983.
Ohio State Univ., Columbus. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-233773/AS, Price codes: A03 in paper copy, A01 in microfiche. Annual Report, Sept 1984. 44 p, 3 fig, 7 tab, 31 ref. USGS G862-01. 14-08-0001-G-862.

Descriptors: *Ohio, *Water resources research, Lake Erie, Fluidized bed process, Biological wastewater treatment, Phenols, Fish larvae, Habitat structure, Wetlands, Aquatic vegetation, Phosphorus, Eutrophication, Nutrient loading, Atrizine, Chloroacetamide, Pesticide residues, Algae, Artificial streams, Water quality, Non-point source pollution, Great Lakes.

This report summarizes the activities of the FY 1983 Ohio Water Research Program and includes progress reports for each of the research and technology transfer projects conducted using funds provided by the Geological Survey, U.S. Department of the Interior under provisions of P.L. 95-467. Much of the research program is directed at phosphorus from land surfaces to Lake Erie. One project is testing the hypothesis that the herbicide, atrazine, inhibits the productivity of a stream's algal communities and thus limits the amount of phosphorus that can be processed by that stream. Another project is developing a technique to estimate the amount of dissolved phosphorus being transported in the runoff from agricultural lands, while a third project is investigating the relationships that exist between the quantities of biologically available and non-available phosphorus in the Lake. Other projects being conducted in this program are exploring mechanisms to improve the Lake Erie fishery by manipulating the habitat for the larval fishes in the controlled wetlands of the region and are developing processes for removing phenol from the wastewater at coal processing operations.
W86-02655

UNIVERSITY OF CONNECTICUT INSTITUTE OF WATER RESOURCES FINAL REPORT FOR GRANT NO. 14-08-0001-G832, FY 83-84,
Connecticut Univ., Storrs. Inst. of Water Resources.
C. N. Burke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-242899/AS, Price codes: A03 in paper copy, A01 in microfiche. FY 83 Annual Report, (1984). 34 p. USGS G832-01. 14-08-0001-832.

Descriptors: *Water Resources Institute, Education, Water resources projects, Research projects, Universities, Electroplating, Water pollution treatment, Landfills, Reservoirs, Hydrocarbons.

A synopsis is presented of the results of sponsored research projects from the Water Research Institute Program (WRIP) for the University of Connecticut's Water Resources Institute which acts on behalf of the State of Connecticut in administering this program on the basis of open competition for support of applications from any university or college within the state. This report contains the research synopses of the following one-year projects: 'The destruction of hazardous wastes by ultraviolet catalyzed oxidation.' 'The economic impact of limiting electroplating discharges to achieve specified water quality standards.' 'The detection and effects of aperiodic leachate discharges from landfills.' 'The development of a chlorophyll monitoring program for reservoirs using in vitro fluorimetry.' 'A study of the mechanisms controlling gasoline hydrocarbon partitioning and transport in groundwater systems.'
W86-02658

FISCAL YEAR 1983 PROGRAM REPORT FOR THE OREGON WATER RESOURCES RESEARCH INSTITUTE,
Oregon State Univ., Corvallis. Water Resources Research Inst.
P. C. Klingeman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-246726/AS, Price codes: A03 in paper copy, A01 in microfiche. Annual report, September 1984. 34 p, 3 tab. USGS G864-01. 14-08-0001-G-864.

Descriptors: *Water resources institutes, *Research, *Research projects, *Research programs, Technology transfer, Information dissemination, *Oregon, Acid rain, Water quality, Fisheries, Sedimentology, Water management.

Program and activities of the Oregon Water Resources Research Institute, supported with FY 1983 funds provided by the Water Research and Development Act of 1978 (P.L. 95-467), are described. Eight research projects and the technology/information transfer projects were supported under the Federal State Water Research Institute program. Other research of the Institute during FY 1983 is also summarized.
W86-02666

DIRECTOR'S TECHNOLOGY/INFORMATION TRANSFER PROGRAM 1983-1984,

Oregon State Univ., Corvallis. Water Resources Research Inst.
P. C. Klingeman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-246759/AS, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Corvallis, September 1984. 55 p, 10 append. USGS G864-23. 14-08-0001-G-864.

Descriptors: *Technology transfer, *Information dissemination, *Information exchange, *Water Resources Institutes, Publications, Workshops, *Oregon.

The Oregon Water Resources Research Institue is the focal point for a wide range of inquiries and requests for assistance. The Institute has responded by carrying out a program of technology/information transfer. This has been accomplished by means of seminars, workshops, technical reports, news releases, field site visits, office visits, telephone calls, mail, and committee work. In particular, special efforts have been made to provide public seminars on water policy and management issues, to conduct two interuniversity faculty workshops on university capabilities in water planning and water policy issues, and to assist state agenies in their response to legislative activities involving hydropower site assessments and strategic water planning.
W86-02669

ANNUAL REPORT FY 1985 WATER RESOURCES RESEARCH INSTITUTE OF THE UNIVERSITY OF PUERTO RICO,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-248003/AS, Price codes: A02 in paper copy, A01 in microfiche. Annual report, September 1983. 11 p. USGS G866-01. 14-08-0001-G866.

Descriptors: *Puerto Rico, *Water Resources Institutes, Grants, Research priorities, Planning, Rainfall-runoff relationships, Water quality.

The research activity at the Puerto Rico Water Resources Research Institute during FY 1983 included three research projects and three technology transfer activities. The technology transfer projects completed were a two-day conference on water resources problems in the Caribbean region, the publication of a report on the public water supplies of Puerto Rico, and the updating of the Institute's five-year research plan. The research projects completed were a statistical analysis of spatial and temporal storm rainfall characteristics in Puerto Rico, a study on the fate of priority pollutants in regional wastewater treatment plants in Puerto Rico, and a final one on the digestion of rum distillery slops in a sea water medium.
W86-02680

ILLINOIS WATER RESOURCES CENTER PROGRAM FOR 1983,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
E. Stout.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249043/AS, Price codes: A03 in paper copy, A01 in microfiche. Annual Report No. 19, September 1984. 26 p. USGS G840-01. 14-08-0001-G840.

Descriptors: Water resources, *Illinois, Streamflow, Irrigation, Water quality, Water law, *Water resources research.

The University of Illinois Water Resources Center was established in 1963 to encourage and coordinate university-wide planning and implementation of interdisciplinary programs for research and graduate education in water resources. Since designation by the Department of the Interior as the 'institute' for Illinois, the center's activities have become statewide. This report describes research accomplishments and other activities of the center during fiscal year 1983. The center's fiscal year 1983 research program included a total of six projects. A summary of each research project is presented.
W86-02683

IDAHO WATER RESOURCES RESEARCH INSTITUTE PROGRAM FOR 1983,
Idaho Water Resources Research Inst., Moscow.
G. L. Bloomsburg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-249134/AS, Price codes: A02 in paper copy, A01 in microfiche. Annual Report, December, 1984, 14 p. USGS G839-01. 14-08-0001-G839.

Descriptors: *Idaho, *Water resources research, Suspended load, Administration, Water Resources Institutes, Information exhange, Water quality, Groundwater, Fisheries, Water reuse.

A synopsis is presented of the results of research projects sponsored under Grant Program G839, the 1983 Water Research Institute Program (WRIP) for the University of Idaho Water Resources Institute. The Idaho WRIP package is a sub-set of the Institute's overall research program effort and contains 8 one year projects investigating the following areas: Effects of Suspended Sediments on Stream Invertebrate Detrital Processing and Bioenergetics, Impacts of Individual On Site Sewage Disposal Facilities on Mountain Valleys - Phase II, Abundance Upstream from Dworshak Dam following Exclusion of Steelhead Trout, Hydrologic and Legal Assessment of Ground Water Management Alternatives for Idaho, Calibration of the Snake Plain Aquifer Ground Water Flow Model, Development of a Methodology to Evaluate the Success and Consequences of Establishing Exotic Fishes in Idaho, Enhancement of Duration Curve Prediction Using Short Time Low Flow Measurements, Aquaculture Utilization of Geothermal Wastewater, and Information Dissemination.
W86-02692

OKLAHOMA WATER RESOURCES RESEARCH INSTITUTE, FISCAL YEAR 1983 PROGRAM REPORT,
Oklahoma Water Resources Research Inst., Stillwater.
N. N. Durham, and A. E. Redelfs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-100609, Price codes: A02 in paper copy, A01 in microfiche. Annual Report, (1984). 12 p. USGS G-863-01. 14-08-0001-G-863.

Descriptors: *Oklahoma, *Water resources research, Hydrogeology, Water chemistry, Artificial recharge, Groundwater quality.

A diversity of needs for the state and region required a broad base of research projects to study, obtain and analyze data, and provide decision makers with sound information on which to base decisions that will affect the quality and quantity of water in the area for future use. The FY 1983 OWRRI Annual Cooperative Program included five research projects, and all made significant contributions to the data base needed for sound decision-making. Some of the contributions and conclusions included: (1) Data collection and lab analysis on water quality, aquifer use, geomorphology, and mineralogy on the potential contamination of a large and extensively used aquifer in northeast Oklahoma, which will be utilized in the second portion of a two-phase project; (2) Development of a microwave dielectric method to apply to the measurement of fluid flow in soil columns; (3) The determination that artificial recharge of aquifers may be feasible on a local scale; (4) The training of water resource professionals in the use of computer models to predict the flow of potential contaminants in ground water supplies; and (5) increased liaison with state and federal representatives, researchers, water resource professionals, and the public.
W86-02701

WEST VIRGINIA FY 1983 INSTITUTE FINAL PROGRAM REPORT,
West Virginia Univ., Morgantown. Water Research Inst.
C. L. Dodson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101219/AS, Price codes: A02 in paper copy, A01 in microfiche. Final Report, 1984. 7 p. USGS G877-201. 14-08-0001-G-877.

Descriptors: *West Virginia, *Water resources research, Acid mine drainage, Iron, Heavy metals, Water quality standards, Technology transfer, Communication, Information exchange, Reviews, Education, Sediments, Stream pollution, Fish, Aquatic life, Water pollution effects, Ecology, Chemical properties.

The West Virginia State Water Research Institute Program for 1983 was planned, designed, and done in close collaboration and cooperation with state and federal water agencies. The prime objective was to generate usable research results and information for users. The major specific objective was to obtain new knowledge for use in establishing a rational water-quality standard for iron in streams. Another specific objective was to transfer information on research results related to acid mine drainage to those concerned with establishing iron standards. The 1983 Program comprised two research projects and one technology-information transfer project. The larger research project was customed designed to yield information useful in establishing iron standards, and results indicate that the old arbitrary standard of 1 mg/L was unrealistic, and that rational standards specifically designed for individual streams are possible. The other, relatively small, somewhat exploratory, research project investigated a segment of a major river to determine the characteristics and dynamics of sediment bearing iron and other metals originating from acid mine drainage. Results indicate that the sediments adsorb metals from the river water and that agitation by passage of towboats maintain conditions that immobilize the metals. The technology-information project was designed to inform the user of results of the acid-mine-drainage research of the state water-research-institute program. Results indicate that under the time-constraint conditions prevailing, direct personal contact was the preferred method of transfer.
W86-02702

FY 1983 FINAL PROGRAM REPORT, ALABAMA WATER RESOURCES RESEARCH INSTITUTE OF AUBURN UNIVERSITY,
Auburn Univ., AL. Water Resources Research Inst.
J. C. Warman, and D. H. Block.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101235/AS, Price codes: A02 in paper copy, A01 in microfiche. Program Executive Summary, revised May, 1985. 12 p. USGS G889-01. 14-08-0001-G880.

Descriptors: *Activated sludge, *Groundwater pollution, *Irrigation efficiency, *Erosion, *Aquifer, *Aquitard, *Computer modeling, *Technology transfer.

Alabama's Water Resources Research Institute began expenditure of FY 1983 funds under Grant No. 14-08-0001-G880 about June 1, 1983, supporting six research projects. One project performed a sensitivity analysis of a biological toxicity model of an activated sludge process. The analysis indicated that the single most important factor in determining model output (based on the effluent organics concentration) is the retention time in the reactor and the second most important factor is the floc radius. Other projects addresses biodegredation of potential ground water pollutants by microorganisms in subsurface soil horizons; optimization of irrigation techniques to reduce water needs for fields with irregular boundaries; the effect of saltwater intrusion on soil erodibility of marshland; the mechanics of ground water aquifer/aquitard expansion caused by heating; and permeability changes in clay and chalk flow barriers caused by hazardous wastes. In addition to the development and management of this cooperative program with the Geological Survey and continuing efforts in

information transfer, the Institute remains active in the development of support for water resources research from other sources.
W86-02704

FISCAL YEAR 1983 WATER INSTITUTE PROGRAM REPORT,
Iowa State Water Resources Research Inst., Ames.
T. A. Austin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101250/AS, Price codes: A04 in paper copy, A01 in microfiche. Annual Report, 1985. 52 p, 12 ref. USGS G842-01. 14-08-0001-G-842.

Descriptors: *Iowa, *Water resources research, Groundwater, Safe yield, Surface water/groundwater interaction, Bank erosion.

This report summarizes the accomplishments from the FY 1983 Water Institute Grant program of the Iowa State Water Resources Research Institute. Two projects deal with groundwater management with emphasis on surface water/groundwater interactions (G-842-03) and estimating aquifer safe yields (G-842-02). Two projects deal with erosion with emphasis on stream bank erosion (G-842-04 and G-842-06). Project G-842-04, 'Bank Erosion Contribution to Stream Sediment Load' was completed. The remaining projects are continuing in FY 1984.
W86-02706

COLORADO WATER RESOURCES RESEARCH INSTITUTE, ACTIVITIES REPORT, FY1981-1984,
Colorado Water Resources Research Inst., Fort Collins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-101367/AS, Price codes: A03 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute Final Program Report, Fort Collins, June, 1985. 23 p. USGS G895-01. 14-08-0001-G895.

Descriptors: *Research, *Information transfer, *Training, *Colorado, *Water Resources Institutes, River Basin Development, Water management, Computer models, Water conservation, Water quality control, Urban drainage, Drought resistance.

An overview is provided of activities of the Colorado Water Resources Research Institute during FY1981-1984. Research projects, public service and educational activities described in the report illustrate the practical problem-solving mission of the Institute. It has conducted water research for 20 years with partial support under P.L. 88-379 (as amended), the Water Research Act of 1964. The report provides a summary of Institute programs for FY1981-84, including sources of funding, number of research projects conducted, number of faculty members involved, number of graduate research assistants and similar statistics. The Institute's organization and mode of operation are described including functions of advisory committees, analysis of research needs, identification of research priorities and formulation of the Institute's research program. Services provided to the executive department of state government, the Colorado General Assembly, municipalities, industry and the general public are also described. Selected examples of completed research include: integrated basinwide water management; surface and groundwater management; groundwater recharge; urban drainage; computer-assisted water resources planning; urban water conservation; development of drought-tolerant crops; and water quality management for metal mining operations.
W86-02717

FISCAL YEAR 1984 PROGRAM REPORT (MISSISSIPPI WATER RESOURCES RESEARCH INSTITUTE),
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
M. T. Bond.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-126125/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report No G-915-01, September 1985. 20 p, 2 tab. USGS G915-01. 14-08-0001-G915.

Descriptors: *Research, *Information transfer, *Training, *Mississippi, Ground water management, Economic aspects, Political aspects, Water policy, Water use, Water law, Water allocation, Management planning, Irrigation practices, Water reuse, Surface-ground water relations, Mathematical models, Sedimentation.

During the 1984 Program Year the Mississippi Institute's involvement in statewide planning activities and its research program addressed major issues in Mississippi, which include but are not limited to water management needs, surface water quality, erosion and sedimentation and flood plain management. Project Number G915-02 was designed to provide an economic and institutional assessment of alternative strategies to deal with the types of ground water mining problems encountered in Mississippi and to determine how solutions can best be implemented and administered through a functional framework. Project Number G915-03 evaluated existing water management plans from 31 states, analyzed responses to a survey of community water managers in Mississippi, and delineated criteria for a water management plan in a water surplus state. Project Number G915-04 studied options for using surface supplies in place of ground water for irrigation by evaluating equipment and making cost comparisons of three configurations of a center pivot system. Project Number G915-05 developed a mathematical model for investigating the effect of sedimentation processes on water resources systems. (First year of two-year project). Project Number G915-22 supported the Institute program through publication and dissemination of research results and promotional and information materials, response to requests for information and programs, and coordination of the Mississippi Water Resources Conference and publication of its proceedings.
W86-02722

FISCAL YEAR 1984 PROGRAM REPORT (TEXAS WATER RESOURCES INSTITUTE),
Texas Water Resources Inst., College Station.
W. R. Jordan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-126190/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-935-01, September 1985, 28 p. USGS G935-01. 14-08-0001-G935.

Descriptors: *Research, *Information transfer, *Training, *Texas, Reservoir operation, Flood control, Hydroelectric power, Aquifer recharge, Artificial recharge, Playa lakes, Water conservation pricing, Infiltration, Furrow infiltrometer, Surface irrigation, Surge flow irrigation, Hydraulic modeling, Stormwater, Drainage, Flood forecasting, Detention basin, Flood plain.

The Institute's 1984 annual cooperative program concentrated on topics related to conservation of the state's water resources. A management strategy for dynamic reallocation of storage capacity between flood control and conservation purposes were shown to enhance total water resource benefits. The reservoir evaluation methodology is expected to be generally applicable to multiple use reservoirs. Surface waters captured in playa lakes could also be conserved if appropriate methods could be developed for artificial groundwater recharge. Rapid, natural infiltration does occur if sufficient runoff occurs to fill the playas beyond the limits of the clay covered bottom, but the water volume retained by the clay bottom is usually lost to evaporation. Detailed analysis of playa flooding suggests that from 27 to 43% of the total runoff recharges naturally; the remaining 57 to 73% is available for artificial recharge. User charges may be used as a form of water demand management to encourage conservation. A case study of the Austin-San Antonio corridor was undertaken to examine pricing and taxation as means to encourage conservation. Results will be included in the FY85 report. Surge irrigation is a potentially important advance in technology that allows even distribution of water along furrows thus reducing deep percolation and tailwater waste. A simulation model was developed to account for dynamic changes in infiltration rates in order to optimize surge operation procedures. A watershed model was prepared for use on a microcomputer and used as part of a Flood and Flood Plain Analysis short course to be offered annually. The users manual and diskettes are available for purchase and are currently in use by 10 cities and 20 consulting firms.
W86-02729

FISCAL YEAR 1984 PROGRAM REPORT (MISSOURI WATER RESOURCES RESEARCH CENTER).
Missouri Water Resources Research Center, Rolla.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132313/AS, Price codes: A02 in paper copy, A01 in microfiche. Program Report G-916-01, September 1985. 19 p. USGS G916-01. 14-08-0001-G916.

Descriptors: *Research, *Information transfer, Training, *Missouri, Tetrachloro-p-dioxins, Vapor-phase migration, Effects of co-pollutants, Soil contamination, Soil detachment, Fall-cone shear strength, Rainfall erosion, Clay, Permeability, Hazardous waste, Unsaturated flow, Drinking water, Microbiology, Turbidity.

The Missouri Water Resources Research center's goals are: (1) sponsor, coordinate and administer research projects on Missouri's water problems, (2) provide training opportunities in research for men and women interested in careers in water resources and related fields, and (3) conduct an active technology transfer which includes conferences, workshops, newsletters, and water center research reports. Each of the four research projects funded under this grant produced valuable information to Missouri problems, and student involvement was encouraged on all projects. Research covered (a) study of cropping effects on soil properties related to water infiltration, runoff and soil loss using simple laboratory methods; (b) influence of permeant and clay chemistry on the hydraulic conductivity of compacted clays used as liners for hazardous waste disposal landfills, Phase II; (c) disposition of polychlorinated dibenzo-p-dioxins, vapor-phase migration, effect of co-pollutants, soil contamination; and (d) microbiological and chemical changes in drinking water systems caused by increased temperature during the summer months.
W86-02731

FISCAL YEAR 1984 PROGRAM REPORT (VIRGINIA WATER RESOURCES RESEARCH CENTER).
Virginia Water Resources Research Center, Blacksburg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132339/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-938-01, September 1985. 26 p. USGS G938-01. 14-08-0001-G-938.

Descriptors: *Research, *Information transfer, *Training, *Virginia, Fish, Instream flow, Habitats, Groundwater, Contamination, Underground storage, Data storage and retrieval, Water quality data.

This report summarizes the Virginia Water Center's efforts to contribute to the solution of Virginia's high priority water resource problems. Program focus during federal FY 84 was on decreasing barriers to development of a water resource planning process and assessing the impact of land use practices on water resources. Three research projects were supported with institute program funds. Project 02 provides an approach to recommending instream flows based on hydrologic statistics for streams in the upper James River basin. Project 03 offers three alternative options for managing underground petroleum storage tanks for Virginia. Project 04 completed a two-year project on evaluating alternatives for a water quality data clearinghouse for Virginia. Publications were the primary vehicle utilized to promote the application

and dissemination of research results. Water News continued to highlight important water resource problems, research findings, conference and seminar schedules, and new publications. Also published were bulletins on the agricultural use of sewage sludge, effects of land use practices on water resources in Virginia, new procedures for resolving conflicts over interjurisdictional water transfers, the economic feasibility of expanded irrigation in Virginia, methods of analyzing instream flows, and public participation. Three special reports improved the information available in Virginia concerning interjurisdictional transfers and acid rain. The education program produced homeowners' guides to wells and septic systems, two exhibits, a slide-tape program and a booklet presenting an overview of the state's surface and ground waters.
W86-02733

FISCAL YEAR 1984 PROGRAM REPORT(OREGON WATER RESOURCES RESEARCH INSTITUTE),
Oregon State Univ., Corvallis. Water Resources Research Inst.
P. C. Klingeman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132347/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-928-01, September 1985. 44 p, 2 tab. USGS G928-01. 14-08-0001-G928.

Descriptors: *Research, *Information transfer, *Training, Oregon, Transpiration, Juniper trees, Culverts, Roads, Estuaries, Algae, Nutrients, Yaquina Bay, Salmon, Minimum flow, Aquatic habitats, John Day River, Regulated flow, Invertebrates, Wild rivers, White water, Recreation, Rogue River, Water management, Microcomputers, Forecasting, Groundwater, Conjunctive use, Goose Lake Basin, Water law.

The FY 1984 Oregon Water Resources Research Institute program included 10 projects concerned with water management of forest, range, agricultural and estuarine zones, including the associated biological resources, problem areas of Oregon water law, and technology/information transfer activities for state water management. Brief summaries of research findings are presented for each project: 02, Water Budget Model of Western Juniper; 03, Assessing Culvert Effectiveness in Mountainous Terrain; 04, Impact of Estuarine Benthic Algal Production on Dissolved Nutrients and Water Quality in the Yaquina River Estuary; 05, Minimum Flow Needs for Juvenile Salmonids in Central Oregon Streams; 06, Effects of Long-Term Regulated Flow on Community Composition of Stream Invertebrates; 07, Valuation of the Rogue River for Whitewater Recreation; 08, Real-Time Data Acquisition and Forecasting for Local Water Management; 09, Alternative Approaches to Management of Water Resources of Goose Lake Basin, Oregon-California; 10, Oregon Water Law and Water Resource Management; 22, Technology and Information Transfer for Oregon's Water Resources Management.
W86-02734

FISCAL YEAR 1984 PROGRAM REPORT (NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE),
New Mexico Water Resources Research Inst., Las Cruces.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132354/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-922-01, September 1985. 21 p. USGS G922-01. 14-08-0001-G922.

Descriptors: *Research, *Information transfer, *Training, *New Mexico, Recharge, Groundwater, Infiltration, Isotopic tracers, Monte Carlo simulation, Computer model, Ion exchange, Adsorbants, Biological filters, Heavy metals, Alfalfa, Plant physiology, Selective media.

The New Mexico Water Resources Research Institute's (WRRI) goal is to maintain a well balanced program of research to address critical state, regional and national water problems. The institute has targeted four areas as high priority for institute funding. They are: (1) Water Conservation, particularly in agriculture. (2) Water Quality Research. (3) Saline water Research and, (4) Surface-Ground Water Relationships. The institute's USGS program attacked three of these four areas. 'Improving water use efficiency in alfalfa by genetic engineering' compares a water use efficient alfalfa produced in earlier research and the unimproved parent stock to see which differences in biochemical or genetic parameters would be useful in cell selection. 'Biosorption of heavy metal ions in water' investigated the use of algae to extract toxic material from industrial amd mining wastewaters. The project has shown that algae can effectively biosorb most heavy metal cations and many oxyanions such as selanide. Most of the sorbed metals can be released and recovered by appropriate pH manipulation. 'Groundwater basin parameter estimation and simulation under uncertainty' and 'Quantification of groundwater recharge rates in New Mexico using bomb 36Cl as a soil-water tracer' both examined surface-groundwater relationships. The first of these projects has been studing the sources and magnitudes of uncertainties in predictive hydrologic models. The second project uses the pulse of radioactive chlorine and tritium released during atmospheric nuclear testing to measure soil-water and soil-water vapor movement in arid soils. Preliminary results indicate that the 36Cl has infiltrated to a depth of 1m in the 22 years since testing ended.
W86-02735

FISCAL YEAR 1984 PROGRAM REPORT (ALABAMA WATER RESOURCES RESEARCH INSTITUTE),
Auburn Univ., AL. Water Resources Research Inst.
J. C. Warman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132362/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-890-01, September 1985. 20 p. USGS G890-01. 14-08-0001-G890.

Descriptors: *Research, *Information transfer, *Training, *Alabama, Activated sludge, Toxins, Microbial degradation, Organic compounds, Biological wastewater treatment, Acidic water, Benthic fauna, Tidal hydraulics, Environmental effects, Lagoons, Organic wastes, Clay permeability, Water conservation.

Under grant No. 14-08-0001-G890 the Auburn, Alabama Water Resources Research Institute provided support for eight research projects. One project developed a unique mathematical model for the activated sludge process. The model takes into account the flow pattern in the reactor, intraparticle mass transport of nutrients, biochemical reactions by individual cells embedded in the floc and inhibition and toxicity effects on cellular reactions. Other projects addressed biodegradation of potential groundwater pollutants by microorganisms in subsurface soil horizons; domestic wastewater treatment and effluent mutagenicity relationships; simulated acidification effects on benthos of southern fishponds; tidal inlet hydraulics and selected environmental parameters associated with small lagoons in developing areas; use of consolidation tests for assessing effects of certain organic fluids on clay permeability; eliminating the use of water in preparation of textile yarn for weaving and fabric desizing; permeability changes in clay and chalk flow barriers caused by hazardous wastes. In addition to the development and management of this cooperative program with the Geological Survey and our continuing efforts in information transfer, the Institute remains active in the development of support for water resources research from other sources.
W86-02736

FISCAL YEAR 1984 PROGRAM REPORT (ARIZONA WATER RESOURCES RESEARCH CENTER).
Arizona Water Resources Research Center, Tucson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132370/AS, Price codes: A04 in paper copy, A01 in microfiche. Program Report G-892-01, September 1985. 52 p, 8 ref, 6 tab. USGS G892-01. 14-08-0001-G892.

Descriptors: *Research, *Information transfer, *Training, *Arizona, Volatile organics, Trihalomethanes, Viruses, Septic tanks, Geochemistry, Ground-water recharge, Conjunctive conservation, Paleohydrology.

The research projects of the Arizona Water Resources Research Center (1984) addressed the following critical water issues: water quality, conjunctive management, water conservation, and water management. Project O2 dealt with the seasonal, diurnal, and storm-related changes in volatile organics in alluvial vadose zones. Projects 03 and 04 examined the fate of trihalomethanes and viruses, respectively, in ground water. During Project 05 a modified septic tank design was examined for areas with failing leachfields. Project 06 dealt with geochemical factors modifying imported water during ground-water recharge. The technical and legal-institutional elements of a conjunctive management program using Central Arizona Project water in Butler Valley were examined during Project 07. During Project 09 a domestic residence was retrofitted to conserve water by water harvesting and grey-water reuse. The focus of Project 08 was on predicting extreme flood events in the southwest using methods of paleohydrology. The information transfer element of the Program comprised the publication of a news bulletin and project bulletins and disseminating program-related publications.
W86-02737

FISCAL YEAR 1984 PROGRAM REPORT (NEW HAMPSHIRE WATER RESOURCES RESEARCH CENTER),
New Hampshire Univ., Durham. Water Resources Research Center.
G. L. Byers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132412/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-920-01, September 1985. 22p. USGS G920-01. 14-08-0001-G920.

Descriptors: *Research, *Information transfer, *Training, *New Hampshire, Water pollution, Contamination, Toxicity, Aluminum, Environmental isotopes, Groundwater, Eutrophication, Lakes, Hydrologic regimes, Streamflow, Air pollution, Acid rain.

This report covers the activities of the New Hampshire Water Resource Research Center for the period July 1984 to September 30, 1985. The results of four research projects are briefly discussed. Two of the projects relate to the acid precipitation problem, one relates to radon levels in groundwater and one describes the social aspects of hazardous waste disposal. A listing of publications and papers presented is included.
W86-02741

FISCAL YEAR 1984 PROGRAM REPORT (NEW YORK WATER RESOURCES RESEARCH INSTITUTE).
Cornell Univ., Ithaca, NY. Center for Environmental Research.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132420/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-923-01, September 1985. 21 p. USGS G923-01. 14-08-0001-G-923.

Descriptors: *Groundwater, *Groundwater quality, *Models, *Pesticide residues, Chemical pollution, Toxicants, Soils, Land use, Remote sensing, Satellite technology, *Research, *Information transfer, *Training, *New York.

The Institute's 1985 program aimed to achieve its goals to develop better fundamental understanding about causes and effects of sources or forces which could impair the use of groundwater for water supplies and techniques to assist communities and

agencies in the efficient and cost-effective acquisition and application of data for dealing with groundwater problems. A prototype computer software package was developed in Porter's project that will assist communities and agencies to make preliminary diagnoses of groundwater problems. Loucks and Liu have improved methods by which probailities of contaminant concentration at wells can be assessed and the cost-risk relation of various options can be estimated. Lemley and Wagenet designed an inexpensive laboratory technique that gives a quick method of screening chemicals with regard to their mobility in soil. Steenhuis improved an evaluatory computer model--the Method of Underground Solute Evaluation (MOUSE) to make it user friendly. The model uses color graphics to display water and contaminant budgets in soil and groundwater. Alexander addressed the issues of how rates of biodegradation due to microbial action may change as the concentrations of specific chemicals change. Philipson and Philpot explored the use of image data from Landsat satellite sensor, the 'Thematic mapper' to recognize land use and cover types which impact on hydrologic processes.
W86-02742

FISCAL YEAR 1984 PROGRAM REPORT (INDIANA WATER RESOURCES RESEARCH CENTER).
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. H. Cushman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132438/AS, Price codes: A03 in paper copy, A01 in microfiche. 20th Annual Report G-905-01 September 1985. 37 p., 1 tab. USGS G-905-01. 14-08-0001-G905.

Descriptors: *Research, *Information transfer, *Training, *Indiana, Nitrogen cycle, Nitrogen remover, Cation exchange, Tracer, Pollutant, Mathematical model, Agricultural runoff, Nuisance algae, Fertilizers, Fishing, Management planning, Recreation, Strip mine lakes, Microbiological studies, Anaerobic bacteria.

In the Indiana Water Resources Research Center program (1984), Dr. Allan Konopka studied sulfate reduction by microbes as a means of neutralizing acid in lakes. His principal finding was that sulfate-reducing bacteria can metabolize at acidic pH at rates comparable to those found in pH-neutral systems. Dr. Lee Somers evaluated the impact of water chemistry on ammonia speciation and volatilization and the effect of cation exchange reactions on controlling the ammonium level in surface waters. Dr. Carole Lembi studied how agricultural practices that result in the greatest reduction in nitrogen input into surface waters affect the growth of certain nuisance filamentous algae. Dr. Darrell Leap built a laboratory sand tank to examine the validity of a multiple-pulse, single-well tracer test for determining aquifer flow velocities. He found that the method gives reasonable estimates of ground water velocity within bounds that can be statistically estimated. Dr. Joseph O'Leary attempted to empirically develop an activity specialization index that classifies different user groups in relation to fishing activities, and evaluate the impact of resource access on activity specialization. The principle information transfer activity of the center was a conference jointly sponsored by the center and the Department of Energy. The conference dealt with the use of, and future use of, supercomputers in subsurface hydrology with emphasis on transport of organics. 'The Analysis of Organic Pollutants in Water By High-Performance Liquid Chromatography with a Swept-Potential Electrochemical Detector,' by Peter E. Sturrock. Analyses at low concentrations of carbamate, triazine and dinitriloaniline compounds were developed and compared with uv detectors to attain high sensitivity for pesticides and herbicides in water. 'Drainage-Subirrigation System Evaluation for Georgia Flatwoods,' by E.D. Threadgill, A. Shirmohammadi, and D.L. Thomas. The effectiveness of subirrigation was compared to center-pivot and traveling-gun irrigation for several crops in loamy sand soil where drainage is needed to support farm equipment, but water is poorly retained by the soil. 'Technology Transfer for Solution of Water Conservation, Reuse and Water Treatment Problems of Major Generic Industries in Georgia,' by Frederick G. Pohland. Research needs of Georgia industries for providing adequate water supply and wastewater treatment were surveyed to provide appropriate information transfer.
W86-02743

FISCAL YEAR 1984 PROGRAM REPORT (VIRGIN ISLANDS WATER RESOURCE RESEARCH CENTER).
Caribbean Research Inst., St. Thomas, VI. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132446/AS, Price codes: A02 in paper copy, A01 in microfiche. Program Report G-939-01, September 1985. 13 p. USGS G939-01. 14-08-0001-G-939.

Descriptors: *Research, *Information transfer, *Virgin Islands, Cisterns, Rain water, Water harvesting, Pathogenic bacteria.

The Fiscal Year 1984 program of the Virgin Islands Water Resources Research Center was oriented mainly towards dissemination of information to the public on research that was done in the past by the Center. Several formal presentations were made on previous research activities and plans for the future. A long-needed brochure describing the Center was also prepared. Research was conducted on the presence of pathogens in drinking water supplies in the Virgin Islands and the validity of various methods for their detection. Results indicated that pathogen levels are high and that current indicators used for detecting contaminated water were useless in many instances.
W86-02744

FISCAL YEAR 1984 INSTITUTE PROGRAM REPORT (ARKANSAS WATER RESOURCES RESEARCH CENTER).
Arkansas Water Resources Research Center, Fayetteville.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132453/AS, Price codes: A03 in paper copy, A01 in microfiche. Institute Program Report G893-01, September 1985. 32 p. USGS G892-001. 14-08-0001-G893.

Descriptors: *Research, *Information transfer, *Training, *Arkansas irrigation practices, Scheduling, Computer model, Soil salinity, Rice, Agriculture, Groundwater contamination, Economic Efficiency, User charges, Water management, Simulation, Electronic, Educational, Algae, Habitat, Reservoirs, Chemical analysis, Coal mining, Ground water.

Arkansas' major water problems are floods, droughts, water quality, goundwater mining, institutional arrangements, laws, financing, environmental concerns and public awareness. From this generalized list of problems, a more specific list was developed by the Technical Advisory Committee to provide goals and priorities for the principal investigators. Specific areas for research include three projects on agricultural water, one on financing water projects and three technology transfer projects. The agricultural projects cover optimal allocation and scheduling of irrigation water, the behavior of soluble salt in clay and trace levels of pesticides in ground water. Institutional arrangements and financing alternatives for state and local water programs are discussed in a timely report. The technology transfer projects include water managment simulator presentations, qualitative and quantitative algal data compilation for macrotrends and the chemistry of water in Arkansas' coal basins. In these research and technology transfer projects, twenty-five graduate and undergraduate students received training.
W86-02745

FISCAL YEAR 1984 PROGRAM REPORT (KENTUCKY WATER RESOURCES RESEARCH INSTITUTE).
Ewald (William R.), Jr., Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132461/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-908-01, September 1985. 33 p, 8 ref. USGS G 908-01. 14-08-0001-G908.

Descriptors: *Research, *Information transfer, *Training, *Kentucky, Suspended solids, Overland flow, Visual resources, Stormwater management facilities, Dechlorination, Karst pollution, Water distribution systems.

The Kentucky Water Resources Research Institute Annual Report for Fiscal Year 1984 describes the problems and issues for the Commonwealth as determined by the State Advisory Council. The program goals and priorities of the Institute describe the areas of research the program addressed. A synopsis of each of the seven research projects is included. The seven projects funded by the Institute in Fiscal Year 1984 are: 02 - Identification of Soil-Water Chemical Parameters for the Prediction and Treatment of Suspended Solids in Surface Water Reservoirs of Coal Mine Lands; 03 - Modeling of Overland Flow by the Diffusion Wave Approach; 04 - A Model for Assessing the Visual Resources of River Basins as an Aid to Making Landuse Planning Decisions; 05 - Development of General Guidelines for the Planning of Stormwater Management Facilities; Application to Urban Watersheds in Kentucky; 06 - Reductive Dechlorination of Toxic Chlorocarbons; 07 - Investigation of Pollution in a Karst Aquifer Utilizing Optical Brightener; and 08 - Hydraulic Design Algorithms for Upgrading and Enhancing Water Distribution Systems. A brief description of the Institute's information transfer activities is provided along with the cooperative arrangements that exist between the Institute and other institutions. The State and University Advisory Councils are listed for 1984. The training accomplishments by fiscal year 1984 research projects is given in terms of category and academic level.
W86-02746

FISCAL YEAR 1984 PROGRAM REPORT (MAINE LAND AND WATER RESOURCES CENTER).
Maine Univ. at Orono. Land and Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132479/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-910-01, September 1985. 24 p, 2 fig, 9 ref. USGS G910-01. 14-08-001-G910.

Descriptors: *Research, *Information transfer, *Training, *Maine, Acidification, Macroinvertebrates, Potable water, Radioactivity effects, Acid rain, Fog, Recreation, Rivers, Landfills, Leachates, Waste treatment.

Five research projects and a technology transfer project were funded under the FY-84 program: 'Effects of Acidification on Pond and Stream Macroinvertebrates' (G910-02); 'Radon in Houses Due to Radon in Potable Water' (G910-03); 'A Comparison of the pH of Coastal fogs with the pH of Interior High-Elevation Fogs' (G910-04); 'Estimating the Value of River-Related Recreational Activities' (G910-05); 'Treatment of Leachate from Toxic and Hazardous Wastes' (G910-06); and 'Technology Transfer in Water Resources Management' (G910-22). The macroinvertebrate study (02) found that small C. triangulifer nymphs were most susceptible to low acidity. Various naturally occuring concentrations of aluminum do not affect its survival. Other insects were evaluated for sensitivity to pH fluxes at various stages of their development. The radon study (03) found that the average radon in the air in sampled houses due to radon in water varied from .8 to 77 pCi/1. The calculated dose for radon exposure leading to radon daughter dose ranged from 0.02 to 1.6 working level months/month. The study of river recreation values (05) Estimated visitor-day values from $1 to $12 on the West branch of the Penobscot and from $1 to $6 on the Saco. The Contingent value method estimates were significantly influenced by the framing of the questions. Preliminary results of the acid fog study (04) indicate that fog from the

high elevation site is slightly more acidic than average coastal fog (3.14 versus 3.66), but that the pH of fogs from various coastal sites varies significantly (3.08 at Damariscove Island to 4.12 at Mount Desert Rock). The leachate study (06) is evaluating the capacity of peat for treatment of metal ions and organics in landfill leachate. Column studies have determined adsorption isotherms for seven metal ions. Higher peat compaction densities improved metal removal.
W86-02747

FICAL YEAR 1984 PROGRAM REPORT (GEORGIA ENVIRONMENTAL RESOURCES CENTER).
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132859/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-900-01, September 1985. 27 pp. USGS G900-01. 14-08-0001-G900.

Descriptors: *Research, *Information transfer, *Training, *Georgia, Ground water movement, Finite element analysis, Model studies, Simulation analysis, Wastes, Water quality, Coastal marshes, Drainage, Electrochemistry, Chemical analysis, Irrigation, Water table.

The FY 1984 Program included the following seven projects: 'A Simplified Approach to Regional Multilayered Aquifer Analysis,' by M. M. Aral. transfer among aquifers due to seepage and pumping is treated with differential equations and the finite element Galerkin Matrix procedure. 'Estimating the Surface Water Resources of the Georgia Coastal Plain and Predicting the Effects of Changing Land-Use Patterns,' by George A. Brook. A hydrologic simulation model was developed for stream flow in the coastal region, where inflow results from groundwater discharge into the stream bed. 'Heavy Metal Composition of Treated Municipal Wastewater and Sludge Residues, by Gian S. Ghuman. The transfer of manganese, zinc, cadmium, copper, nickel and chromium from wastewater to liquid effluent and sludge was observed, as well as the leachability of these metals from ashed sludge. 'Analysis of Wetland Trends and Management Alternatives for Georgia,' by James E. Kundell. Information is presented on the types, location, and extent of wetlands in the state, and current as well as potential laws and regulations governing the use of the lands.
W86-02748

FISCAL YEAR 1984 PROGRAM REPORT (NEBRASKA WATER RESOURCES CENTER).
Nebraska Water Resources Center, Lincoln.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132867/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G918-01, September 1985. 30 p. USGS G918-01. 14-08-0001-G918.

Descriptors: *Research, *Information transfer, *Training, *Nebraska, Soil fungi, Soil erosion, Nitrates, Denitrification, Water treatment, Conjunctive use, Alluvial aquifers, Consumptive use, Evaporation, Transpiration, Gully erosion, Urbanization, Vegetation effects, Channel morphology, Remote sensing, Groundwater.

Water problems in Nebraska addressed by 1984 research program projects included: nitrate contamination of groundwater; declining groundwater levels; effects or irrigation on the Sandhills; impact of irrigation diversions on wildlife habitat; and stream channel erosion in urban areas. Project 02 studied whether disturbed sandy soils are deficient or lacking in vesicular-arbuscular mycorrhizae and if the reintroduction of mycorrhizal fungi into these soils in the revegetation process improves the survivorship, growth and reproduction of plants. Project No. 03 examined the possibility of using a biological treatment for drinking water. Project No. 04 developed a finite-difference computer model to manage a river system and groundwater conjunctively. Project No. 05 developed a field method for separately measuring soil water evaporation and plant water transpiration using minilysimeters. Project No. 06 found that increased runoff caused by urbanization can cause rapid channel degradation by integrating the factors of rate of transition to urban use, stream velocity needed for tractive sediment removal, and slope stability of the channel. Project No. 07 studied encroachment of vegetation and flow relationships in a river using remote sensing techniques, documenting the rate of encroachment from survey maps and aerial photographs. Project No. 08 tested remote sensing using thermal imagery as a means of measuring subsurface water levels in sandy soils.
W86-02749

FISCAL YEAR 1984 PROGRAM REPORT (NEW JERSEY DIVISION OF WATER RESOURCES).
Rutgers - The State Univ., New Brunswick, NJ. Div. of Water Resources.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132875/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-921-01, September 1985. 22 p. USGS G921-01. 14-08-0001-G921.

Descriptors: *Research, *Information transfer, *Training, *New Jersey, Water pollution, Fish, Chlorinated hydrocarbons, Lead, Acidity, Trace elements, Bioindicators, Acid rain, Tidal marshes.

The 1984 New Jersey Water Institute Program focuses on the most critical water issue currently facing the state: the fate and effects of organic and inorganic trace contaminants in surface and ground waters. Five of the projects funded by the Program are directed toward surface waters. Four of these grants address the physical, chemical and biological factors controlling the cycling of various trace elements, particularly lead, in a variety of ecosystems, including a marsh, a swamp, several rivers and a series of acid lakes. The fifth study is determining the effects of combinations of various volatile organic contaminants on a fish species. The final project is identifying factors which influence the behavior of organic contaminants in groundwater systems.
W86-02750

FISCAL YEAR 1984 PROGRAM REPORT (UTAH CENTER FOR WATER RESOURCES RESEARCH).
Utah Center for Water Resources Research, Logan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132883/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-936-01, September 985. 25 p., 3 fig, 2 tab, 15 ref. USGS G936-01. 14-08-0001-G936.

Descriptors: *Research, *Training, *Utah, Heavy metals, Groundwater pollution, Leaching, Waste treatment, Land disposal, Soil amendment, Groundwater, Salinity, Irrigation, Soil physics, Remote control, Communications, Data retrieval, Hydrometeorology, Cloud seeding, Utilities, Domestic water, Water management, Water supply systems, Institutions, Marine sediments, Geochemistry, Mixing.

Utah water resources problems and issues are presented as background for developing a water research program incorporating studies in four areas: A field-scale application of geochemical and solute transport models to water flowing in soil overlying salt bearing strata showed the importance of mapping flow paths and showed that the predominant leaching to be slow upward diffusion of sulfate salts from the bedrock. Farm water management or canal lining reduce short term salt loading but achieve little long run benefit. Field data were also collected on salt movement through the soil profile and showed soil salts to rise during the winter but problem concentrations to be leached below the root zone once irrigation starts. Soil-waste interactions were examined in the laboratory to determine how the metals in industrial wastes can be immobilized in land disposal and land spill sites. Amendments that modify leachate pH and promote sorption are the most effective. The latest remote control technology was reviewed for information on available equipment and its performance, cost, range, power requirements, and other relevant factors. Combined radio telemetry and telephone are the least expensive systems and their use would be enhanced by modernization of FCC Rules and Regulations. Small privately owned domestic water utilities have a particular problem in maintaining dependable service. The situation can be improved by eliminating unjustified discriminatory regulations and by requiring developers to provide satisfactory plans for perpetual service.
W86-02751

FISCAL YEAR 1984 PROGRAM REPORT (TENNESSEE WATER RESOURCES RESEARCH CENTER),
Tennessee Water Resources Research Center, Knoxville.
W. F. Brandes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132891/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-934-01, September 1985, 20 p. USGS G934-01. 14-09-0001-G-934.

Descriptors: *Research, *Information transfer, *Training, *Tennessee, Hazardous wastes, Waste management, Groundwater contamination, Leachate, Soil permeability, Environmental policy, Administrative regulations, Water laws.

This report details FY 84 research work accomplished by the Tennessee Water Resources Research Center under the Department of Interior's Annual Cooperative Program. Foremost was the desire of the Tennessee Water Resources Research Center to direct its funded research efforts towards environmental and growth related issues identified by Governor Alexander's Safe Growth Action Team. Specifically, these issues revolved in and around aspects of water and hazardous wastes; 1) a comprehensive evaluation of environmental protection programs for the State, leading to resolution of legal and institutional restraints on water resources planning and management; 2) a variety of economic, social and political studies relating to problems of government in coping with water resources needs and responsibilities and 3) technical research projects in engineering and in the physical and life sciences designed to assist in resolving such problems as erosion and sedimentation, floodplain management, and groundwater pollution. This report provides an overview of water problems and issues in Tennessee and highlights of four research project/activities: 1) A Method for the Evaluation of the Need for Hazardous Wastes Treatment/Disposal Facilities: 2) Evaluation of the Impact of a Clay Cap on the Migration of Hazardous Materials; 3) Investigation of Conflicts, Overlaps and Gaps in Tennessee's Environmental Protection Programs and 4) Information Transfer Program.
W86-02752

FISCAL YEAR 1984 PROGRAM REPORT (COLORADO WATER RESOURCES RESEARCH INSTITUTE).
Colorado Water Resources Research Inst., Fort Collins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132909/AS, Price codes: A06 in paper copy, A01 in microfiche. Program Report G-895-01, September 1985. 60 p., 3 tab. USGS G89501. 14-08-0001-G895.

Descriptors: *Colorado, Phreatophytes, Evapotranspiration, Consumptive use, *Water quality management, *Effluent standards, Low flow, Water permits, *Water quality standards, Quality control, *Research and development, *Water resources development, Administration, *Technology transfer, Wildlife habitats, Legal aspects, Institutional constraints, *Conjunctive use, *Surface-groundwater relations, Computer models, *Groundwater, Aquifers, Reservoir release.

The Colorado Water Resources Research Institute is the designated management center in Colorado for the Federal Water Research Program. The Institute's Federal FY1984 Program consisted of

six research projects focused on the following Colorado problems: (1) The Endangered Species Act and Water Development within the South Platte Basin; (2) Maintenance of Crane Habitat by Controlled Reservoir Releases--South Platte River; (3) Water Delivery Strategies--South Platte Mainstream Reservoir; (4) Evaluation of Low-Criteria for Effluent Discharge Permits in Colorado; (5) Evapotranspiration of Natural Vegetation in the San Luis Valley, Colorado; and (6) Voluntary, Basinwide Water Resources Management: South Platte Basin, Phase II. In addition, the Institute received state funding for the first time in 1984-85 when the Colorado General Assembly provided $67,000 for water research. Five research projects were supported by this appropriation--three projects at Colorado State University, one at the Colorado School of Mines, and one at the University of Colorado, Boulder: (1) Geochemistry of Aquifer Recharge in the Denver Basin; (2) Guidelines for Developing Basin-of-Origin Compensation; (3) South Platte Basin Simulation Model (SAMSON); (4) Low-Flow Criteria for Discharge Permits (complements Federal program project); and (5) Voluntary, Basinwide Water Resources Management: South Platte River, Phase II (complements Federal program project). The Institute's technology transfer program was fully integrated with its water research and development program. It includes: newsletters; three publications series; distribution of a 'library list' of new water resources research reports and publications; Project AWARE, designed to keep State and Federal agency personnel aware of proposed research; public water policy education (programs including slide presentations); and workshops, seminars, and small groups consultations involving potential users.
W86-02753

FISCAL YEAR 1984 PROGRAM REPORT (DELAWARE WATER RESOURCES CENTER),
Delaware Univ., Newark. Water Resources Center.
R. D. Varrin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-132917/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-897-01, September 1985. 26 p. USGS G897-01. 14-08-0001-G897.

Descriptors: *Research, *Training, *Information transfer, *Delaware, Activated carbon, Activated sludge, Adsorption, Aerobic digestion, Bacterial analysis, Channel erosion, Contamination, Corn, Domestic water, Groundwater, Groundwater pollution, Heavy metals, Industrial water, Irrigation, Municipal water, Nitrogen, Organic compounds, Petroleum products, Regional planning, Sludge, Biodegradation, Storm runoff, Toxins, Water analysis.

Synopses of 6 research projects of the Delaware Water Resources Center are presented. Project 02, 'A Predictive Study for Groundwater Contamination by Petroleum Products,' formulated a model to predict the movement of gasoline in the soil; the work will advance recovery and cleanup of these substances. Project 03, 'Fundamental Concepts of Autodigestion of Biomass, ' focused on determining the extent of biodegradability of the products of autodigestion. This information is critical to design better treatment facilities and to regulate sludge and effluent disposal. Project 04, 'The Removal of Toxic Chemicals by Activated Carbon Process from Contaminated Groundwater,' focused on removing concurrently heavy metals and organic compounds from ground water. The results indicate that activated carbon is effective. Project 05 developed a method for 'Rapid, Accurate Identification of Bacterial Pollutants in Domestic, Institutional, and Industrial Water Supplies.' Fatty acid profiles were developed for bacterial pollutants and linked with a computer for identification. Project 06 investigated 'Thresholds of River Channel Erosion in Urbanized Piedmont Watersheds.' The results indicate that erosion is affected by frequency, rather than intensity,of stress. Project (07), 'The Influence of Nitrogen Management and Irrigation on Ground-Water Quality,' investigated the effect of intensive irrigaton and fertilizer application on ground-water pollution. The results indicate that greater leaching occurs with increased irrigation but that different fertilizer application treatments have little effect on soil nitrogen. This report also includes a summary of the Delaware WRC's information transfer effort, a newsletter published 3 times a year to summarize research.
W86-02754

FISCAL YEAR 1984 PROGRAM REPORT (PENNSYLVANIA INSTITUTE FOR RESEARCH ON LAND AND WATER RESOURCES).
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-133220/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-929-01, September 1985, 31 p. USGS G929-01. 14-08-0001-G-929.

Descriptors: *Research, *Information transfer, *Training, *Pennsylvania, Deposition, Acidic soils, Deciduous forest, Streams, Eutrophication, Aquatic productivity, Nutrients, Hydrological model, Drought, Monongahela River, Reservoir operation, Consumptive use, Precipitation, Air pollution, Drought resistance, Water conservation, Forest soils, Leachate, Water allocation.

Three Fiscal Year 1983 programs continued in Fiscal Year 1984. One program evaluated the rate and extent of recovery of a stream, dominated by the growth of aquatic vascular plants, following a program of phosphorus removal. Another attempted to determine if the chemistry of soil and soil leachate in Appalachian forests varies with the amount of acidic atmospheric deposition. A third project developed a flow management model to explore alternative approaches to future drought protection for the Monongahela River Basin and examined possible impacts of modifications in reservoir operating policies and low flow consumptive use restrictions. The Institute's technology transfer program was geared to improving the public's understanding about atmospheric deposition and Giardiasis. It was also designed to increase the knowledge of local sewage enforcement officers and water managers about maximum level water conservation devices and to educate local government officials to the potential benefits of hydraulic load reduction through water conservation for malfunctioning on-lot sewage systems.
W86-02755

FISCAL YEAR 1984 PROGRAM REPORT (CALIFORNIA WATER RESOURCES CENTER),
California Univ., Davis. Water Resources Center.
J. H. Snyder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-133238/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report No G-894-01. September 1985. 28 p. USGS G894-01. 14-08-0001-G894.

Descriptors: *California, *Research and development, *Grants, Irrigation, Drip irrigation, Water conservation, Reclamation, Water prices, Acid precipitation, Atmospheric nutrient deposition, Lake Tahoe, Monitoring, Streams, Logging, Chaparral, Burning, Steelhead, Nutrients, Algae, Watershed, DBCP, Soil organic matter, Fumigants, Path of pollutants, Soil contamination.

A synopsis is presented of the results of each of the research projects sponsored under the 1984 Water Research Institute Program (WRIP) for the University of California Water Resources Center. It also contains summaries of water problems and issues in California and the Water Resources Center's Program Goals and Priorities, Information Dissemination Activities and Cooperative Arrangements. The California WRIP package is a subset of the Center's overall research program and consists of five projects investigating the following topic areas: The Diffusion of Low-Volume Irrigation Technology in Western Agriculture, Structural Impacts of the Reclamation Reform Act of 1982 on California Agriculture, The Direct Quantification of Atmospheric Dry Acid and Nutrient Deposition on Western Mountain Lakes, Application of a Paired Watershed Research Design to Evaluate Instream Effects of Watershed Management Activities in North Coastal California, Interaction of Nemagon (DBCP) with Constituents of Water-Soil Systems.
W86-02756

FISCAL YEAR 1984 PROGRAM REPORT (MARYLAND WATER RESOURCES RESEARCH CENTER),
Maryland Water Resources Research Center, College Park.
R. E. Menzer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-133253/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-911-01, September 1985. 22 p. USGS G911-01. 14-08-0001-G911.

Descriptors: *Research, *Information transfer, *Training, *Maryland, Nitrogen, Phosphorus, Groundwater, Estuaries, Trace metals, Geologic history, Sludge, Toxicity, Mutagens, Soil amendments, Acid rain, Nitrates, Sulfates.

Within the framework of the 1984 Program of the Maryland Water Resources Research Center, three projects were focused on questions of pollution of surface and ground water and one on acid rain. An information transfer project focused on the protection of ground water supplies. In a project to assess nitrogen and phosphorus losses via subsurface ground water flow from conventional and no-till corn watersheds, evidence was obtained that the leaching of nitrates into percolate or ground water is not enhanced by the use of no-till cultivation. No phosphate was found in percolate samples from either no-till or conventional cultivation treatments. A two-year study has been conducted to assess the accumulation of toxic metals in the sediments of Maryland's Eastern Shore rivers. Information derived from sediment cores indicates that most of thg trace metals being deposited in the Nanticoke and Choptank Rivers is derived from atmospheric sources. Thus, local industries and waste treatment plants are not the sources of metal pollutants. In a project to determine the impact on human health of contaminants present in sludge applied as soil amendment, ground and surface water have been analyzed for mutagenic compounds. Although mutagens and promutagens were present in the sludge, they failed to be leached downward through the soil. During the first year of a two-year acid fog and acid rain project, collection methods have been developed. Preliminary information on acidity in rainfall indicates increased levels of H+, SO42-, Pb, and Mn over a control area in Tennessee.
W86-02757

FISCAL YEAR 1984 PROGRAM REPORT (PUERTO RICO WATER RESOURCES RESEARCH INSTITUTE).
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-133246/AS, Price codes: A02 in paper copy, A01 in microfiche. Program Report G-930-01, September 1985. 17 p. USGS G930-01. 14-08-0001-G-930.

Descriptors: *Water resources institutes, *Research, *Information transfer, *Puerto Rico, Acid rain, Water quality, Air pollution, Industrial wastes, Fermentation, Environmental effects, Pathogenic bacteria, Activated sludge, Sludge digestion, Anaerobic digestion.

The research activity at the Puerto Rico Water Resources Research Institute during FY 1984 included three research projects and two technology transfer activities. Two of the research projects, one on acid rain in Puerto Rico and another on the anaerobic digestion of sewage sludge, were carried to completion. Still in progress is a study on the effect of treated rum distillery wastes on receiving ocean waters. The technology transfer activities developed were a bibliography of water resources

publications in Puerto Rico and a symposium on tropical hydrology.
W86-02758

FISCAL YEAR 1984 PROGRAM REPORT (SOUTH CAROLINA WATER RESOURCES RESEARCH INSTITUTE).
Clemson Univ., SC. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-133261/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G-932-01, September 1985. 30 p. USGS G932-01. 14-08-0001-G932.

Descriptors: *Research, *Information transfer, *Training, *South Carolina, Pricing evaluation, Economic predictions, Instream flow, Stream classification, Evaporation rate, Irrigation, Irrigation efficiency, Groundwater, Aquifers, Mapping, Adsorption, Activated carbon, Organic wastes.

A discussion of the water problems in South Carolina is presented. To determine the ability of the smaller water supply systems in S.C., a study was conducted of the organization, capital needs and financial capacity of the water supply utility systems. To assure that all stream requirements were met during periods of low flow, a methodology was developed for establishing in-stream requirements and for statistically predicting flow deficiency patterns. To measure water conservation in agriculture, the applicability of a new vapor budget technique for the measurement of evaporative losses from irrigated crop land was investigated. In order to better understand the basic groundwater aquifer system a continuing project is dedicated to the study of the recharge-discharge area, piezometric surface and water chemistry of the tertiary limestone aquifer in South Carolina.
W86-02759

FISCAL YEAR 1984 PROGRAM REPORT (ALASKA INSTITUTE OF WATER RESOURCES).
Alaska Univ., Fairbanks. Inst. of Water Resources.
Available from the National Technical Information Service, Springfield, VA 22161 as PB86-133279/AS, Price codes: A03 in paper copy, A01 in microfiche. Program Report G891-01, September 1985. 25 p. USGS G891-01. 14-08-001-G891.

Descriptors: *Research, *Information transfer, *Training, *Alaska, Hydrographs, Surface runoff, Snowmelt, Water balance, Permafrost, Groundwater recharge, Groundwater quality, Arsenic, Nitrate, Riparian vegetation, Frost management, Taiga, Nitrogen isotopes, Nitrogen geochemistry, Fire, Soil leaching, Groundwater geochemistry.

Five small projects were funded by the United States Geological Survey (USGS) Federal Cooperative Water Resource Program in Fiscal Year 1984. Two projects studied surface water hydrology, one project used biological indicators in streams to assess potential ecosystem perturbations caused by riparian vegetation removal, one project studied groundwater chemistry and one project studied surface water chemistry. All but one project provided partial support for at least one graduate student. Several undergraduate assistants also helped complete our research funded by USGS. During 1984, our Institute of Water Resources administered about 20 water-related research projects and provided training to approximately 15 graduate students and six undergraduate assistants. Cooperative research and/or exchanges were made with Alaskan agencies, the U.S. Environmental Protection Agency and USGS.
W86-02760

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

DIAGNOSING THE CAUSES OF GROUNDWATER CONTAMINATION USING A MATHEMATICAL MODEL,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
For primary bibliographic entry see Field 5B.
W86-02531

INFORMATION DISSEMINATION FOR A BETTER UNDERSTANDING OF LOUISIANA'S WATER RESOURCES,
Louisiana State Univ., Baton Rouge. Hazardous Waste Research Center.
For primary bibliographic entry see Field 9D.
W86-02554

WATER-RESOURCES REPORTS PREPARED BY OR IN COOPERATION WITH THE U.S. GEOLOGICAL SURVEY, KANSAS, 1886-1983,
Geological Survey, Lawrence, KS. Water Resources Div.
L. J. Combs.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report OFR 84-609, 1984. 117 p, 1 map.

Descriptors: *Bibliographies, U.S. Geological Survey, Water data, Data collections, *Water-resources investigations, *Kansas, *Publications.

Water-resources data and the results of hydrologic investigations in Kansas are published or released by the U.S. Geological Survey, by cooperating State or Federal agencies, or by technical or scientific journals. This report lists more than 800 water-resources reports prepared by or in cooperation with the U.S. Geological Survey in Kansas for 1886 through 1983. The reports are listed by author, publication series, year of publication, and subject. The first water-resources investigations by the U.S. Geological Survey in Kansas was completed by A.C. Peale in 1886. The first cooperative program with a State agency was initiated 9 years later in 1895 and included the first stream-gaging stations operated by the Survey in western Kansas. The U.S. Geological Survey continues to investigate the occurrence, quantity, quality, distribution, and movement of surface and ground waters within the State. (USGS)
W86-02818

10D. Specialized Information Center Services

CHAPARRAL MANAGEMENT EFFECTS ON WATER AND THE ENVIRONMENT,
California Univ., Davis. Dept. of Agronomy and Range Science.
For primary bibliographic entry see Field 2I.
W86-02570

WATER DIRECTORY, WHERE TO GET WATER INFORMATION IN NEW MEXICO,
New Mexico Water Resources Research Inst., Las Cruces.
L. G. Harris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-229771/AS, Price codes: A04 in paper copy, A01 in microfiche. New Mexico State Univ. Las Cruces, Water Resources Research Institute. USGS G-858-22.

Descriptors: *New Mexico, *Water information, *Directories, Personnel, Water management, Water rights, Water resources development.

This directory lists water resources professionals in New Mexico who are affiliated with universities, state agencies with responsibilities in New Mexico. In addition, the directory contains a synopsis of the responsibility of each of the agencies with personnel listed.
W86-02606

DIRECTORY OF WATER RESOURCES PERSONNEL IN WISCONSIN.
Wisconsin Univ.-Madison. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-230035, Price codes: A07 in paper copy, A01 in microfiche. Project Completion Report, April 1985. 133 p, append. USGS G878-22. 14-08-0001-G878.

Descriptors: Education, *Scientific personnel, State jurisdiction, universities, Organizations, *Wisconsin, *Directories.

A listing of Wisconsin residents involved in all aspects of water resources research, education, and management.
W86-02611

ASSESSMENT OF THE EFFECTIVENESS OF TECHNOLOGY TRANSFER METHODS LEADING TO THE ADOPTION OF A NEW IRRIGATION DESIGN,
Texas Water Resources Inst., College Station.
For primary bibliographic entry see Field 3F.
W86-02621

DIRECTOR'S TECHNOLOGY/INFORMATION TRANSFER PROGRAM 1983-1984,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 9D.
W86-02669

10F. Preparation Of Reviews

RIPARIAN ZONE SYSTEMS, USES, AND MANAGEMENT,
Oregon State Univ., Corvallis. Water Resources Research Inst.
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W86-02668

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Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

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